Devices and pressure sources for administration of nasal continuous positive airway pressure in preterm neonates

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Short binasal prong devices are more effective than single prong devices in reducing the rate of reintubation. Although the Infant Flow Driver appears to be more effective than Medicorp prongs, the most effective binasal prong device remains to be determined. Short binasal prongs are more effective than nasopharyngeal continuous positive airway pressure in the treatment of early respiratory distress syndrome.

RHL Commentary by Zanardi DMT

1. INTRODUCTION

Nasal continuous positive airway pressure (NCPAP) is widely used as an alternative to intubation and ventilation for providing respiratory support to preterm neonates who have been recently extubated, those suffering from apnoea of prematurity and those with respiratory distress soon after birth. This review (1) sought to determine 'which technique of pressure generation and which type of nasal interface for NCPAP delivery most effectively reduces the need for additional respiratory support in preterm infants extubated to NCPAP following intermittent positive pressure ventilation (IPPV) for respiratory distress syndrome (RDS) or in those treated with NCPAP soon after birth'.

2. METHODS OF THE REVIEW

The review authors consulted expert informants and searched MEDLINE (1966–2006), the Cochrane Central Register of Controlled Trials (Central, the Cochrane Library, Issue 4, 2006), Cumulative Index to Nursing and Allied Health Literature and conference abstracts for randomized or quasi-randomized trials that had compared different techniques of NCPAP pressure generation and/or interface in premature infants extubates to NCPAP following IPPV for respiratory distress syndrome treated with NCPAP soon after birth. The first three authors extracted and analysed the data. The methodology of available trials was assessed for adequacy of blinding of randomization, blinding of intervention, completeness of follow-up and blinding of the outcome measurement.

3. RESULTS OF THE REVIEW

A total of seven trials were included in the review.

*Preterm infants being extubated to NCPAP following a period of IPPV for RDS*

Meta analyses of the results from two trials involving 180 infants demonstrated that short binasal prongs are more effective in preventing re-intubation than single nasal or nasopharyngeal prongs [typical relative risk (RR) 0.59; confidence interval (CI) 0.41–0.85]. There was no significant difference in the rate of re-
intubation between those randomized to Infant Flow Driver versus those in the INCA prong NCPAP group. In the comparison of infants randomized to the Infant Flow Driver versus the INCA (162 infants) prong there was no statistically significant differences in the outcomes of death (RR 2.87; 95% CI 0.79–10.44), chronic lung disease at 36 weeks postmenstrual age (RR 0.86; 95% CI 0.65–1.14), grade three and four intraventricular haemorrhage (RR 0.85; 95% CI 0.41–1.75), periventricular leukomalacia, retinopathy of prematurity, air leak, sepsis and necrotizing enterocolitis. However, in the Infant Flow Driver group there was a significant lower duration of hospital stay [mean difference (MD) ?12.60; 95% CI: ?22.81 to ?2.39 days].

**Preterm infants treated with NCPAP soon after birth**

One trial with 36 infants, reported a significantly lower oxygen requirement and respiratory rate in those randomized to short binasal prongs compared with NCPAP delivered via nasopharyngeal prong. These outcomes were not assessed beyond 48 hours from randomization. There were no deaths in the study and no cases of chronic lung disease or intraventricular haemorrhage in either group. Moreover, no significant differences were found for the rates of pneumothorax or nasal trauma. The oxygen requirement and respiratory rate was not significantly lower in the short binasal prong group beyond 48 hours following randomization.

**Studies randomizing preterm infants to different NCPAP systems using broad inclusion criteria**

Two trials, involving 111 infants, had randomized preterm infants to different NCPAP systems based on inclusion criteria that produced significant heterogeneity in terms of clinical conditions in the groups. These studies demonstrated a significant higher incidence of nasal hyperemia with the use of the Argyle prong, compared with Hudson prongs. When the authors analysed the incidence of nasal hyperemia in each of the three weight strata the increase in nasal hyperemia in the Argyle prong group only reached statistical significance for infants in the ? 1000 g body weight group.

## 4. DISCUSSION

### 4.1 Applicability of the results

Based on the seven small trials available for this intervention, the review authors conclude that short binasal prong devices are more effective than single prongs in reducing the rate of re-intubation. Although the Infant Flow Driver appears more effective than Medicorp prongs, the most effective binasal prong device remains to be determined. The improvement in respiratory parameters with short binasal prongs suggests they are more effective than nasopharyngeal NCPAP in the treatment of early RDS.

The results of the review are applicable to developing countries since the use of NCPAP presents an important alternative to intubation and ventilation for providing respiratory support to preterm neonates. One of the studies included in this review was carried out in Brazil. However, unfortunately most maternity wards in developing countries, including in Brazil, are not equipped with neonatal intensive care units, qualified physicians and nursing staff and all other supporting facilities.

### 4.2 Implementation of the intervention

NCPAP is still not widely known or used in Brazil, even in good neonatal intensive care units, probably because medical staff still prefer traditional methods of mechanical ventilation which have assured the survival and recovery of preterm infants. NCPAP requires technical knowledge and monitoring in order to obtain good results. Hence, training of health-care personnel will be essential for introducing this intervention. However, NCPAP does not require intubation – a procedure which requires even more sophisticated training to apply.

For ventilation to be effective, it is necessary to use prongs of an adequate size which can be adjusted to the nose of the baby. Part of the resistance found in developing countries towards adoption of this mode of
ventilation may be due to the technical difficulties faced by nurses and physicians in its application. There may also be a risk of injury to the nostrils, representing an extra problem to be overcome in preterm infant care. However, NCPAP represents an important alternative mode of ventilation, which is less aggressive for the preterm infant and, if used widely in specialized centers, it can lead to a higher survival rate for preterm infants. In some cases, early use of NCPAP in a preterm infant who is to be transferred to an intensive care unit can assure good delivery of oxygen and reduce early complications which may lead to death.

The adequate and extensive use of the NCPAP in the situations recommended by this review is an option in respiratory support for preterm neonates (2) and can result in the reduction of neonatal mortality, considering that prematurity and lung damage due to extended ventilation are among the main causes of this problem.

4.3 Implications for research

To help introduce NCPAP in under-resourced settings, further research should be conducted on the various techniques of NCPAP, with a special focus on adverse effects and documentation of all indications for the use of the devices involved.

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