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**Jain Shubham**  
Junior Resident 2nd year,  
Dept. of Pediatrics,  
Rohilkhand Medical College &  
Hospital, Bareilly,  
Uttar Pradesh, India

**Chaudhary SR**  
Professor & Head,  
Dept. of Pediatrics,  
Rohilkhand Medical College &  
Hospital, Bareilly,  
Uttar Pradesh, India

**Ahmed SM**  
Assistant Professor,  
Dept. of Pediatrics,  
Rohilkhand Medical College &  
Hospital, Bareilly,  
Uttar Pradesh, India

**Correspondence**  
**Jain Shubham**  
Junior Resident 2nd year,  
Dept. of Pediatrics,  
Rohilkhand Medical College &  
Hospital, Bareilly,  
Uttar Pradesh, India

## Competency and safety of bubble continuous positive airway pressure in preterm neonates with respiratory distress

Jain Shubham, Chaudhary SR and Ahmed SM

### Abstract

**Aim & Objectives:** Bubble Continuous Positive Airway Pressure (B-CPAP) is relatively inexpensive and can be easily taught therefore has the potential to be the optimal respiratory support device for neonates in developing countries. The aim of our study was to determine the competency and safety of B-CPAP in preterm & term neonates requiring respiratory support.

**Material & Methods:** A prospective observational study was done on 50 babies both preterm and term admitted consecutively in NICU of Rohilkhand Medical College & Hospital, Bareilly, requiring respiratory support for mild to moderate respiratory distress based on Downe's score and Silverman Anderson score. Support was given with short nasal prongs connected to Fisher & Paykel B-CPAP. Surfactant was administered when required. Monitoring was done clinically, with pulse oximetry, radiological and with arterial blood gases.

**Results:** The mean gestational age of the study population was 32-34 weeks and birth weight was 1.600kg. 40% of the populations were Very Low Birth Weight (<1.5kg). C-PAP failure rate was higher in these babies. The most common indication of B-CPAP was RDS (84%) followed by pneumonia (6%), TTNB (6%) and MAS (4%). The commonest complications on B-CPAP were nasal abrasion (20%), gastric distension (8%), apnea (4%) and feed intolerance (4%). Overall failure of BCPAP occurred in 11/50 cases or 22%. All babies who failed BCPAP were put on mechanical ventilation. Failures in RDS group were 10/42 or 23.8%, pneumonia group was 1/3 or 33.33% and no failure reported in MAS and TTNB group. Overall survival rate of the study population was 39/50 or 78%.

**Conclusions:** Bubble Continuous Positive Airway Pressure is safe, competent and easy to use in preterm neonates with mild to moderate respiratory distress.

**Keywords:** Safety of bubble, airway pressure, respiratory distress

### Introduction

Bubble Continuous Positive Airway Pressure is a non-invasive strategy for newborns with infant respiratory distress syndrome. Bubble CPAP is one of the low cost nasal CPAP delivering systems with underwater seal [1]. Lee *et al* demonstrated the superiority of bubble CPAP as compared to ventilator derived CPAP in premature infants [2]. Bubble CPAP differs from conventional CPAP in that in B-CPAP the expiratory limb is placed under water and oscillatory vibrations are transmitted into the chest resulting in waveforms resulting in those produced by high frequency ventilation. It is less expensive method of respiratory support, most suitable to neonatal units with limited resources in developing countries [3]. Autopsy studies reveal that 32-52% of all perinatal deaths are due to respiratory distress [4]. It occurs in 60-80% of infants less than 28 weeks gestational age, in 15-30% of those between 32 and 36 weeks, in about 5% beyond 37 weeks and rarely at term [5].

NCPAP may lead to reduced oxygen requirements, intubation rates, and duration of mechanical ventilation [6].

The use of CPAP for RDS produces more regular breathing patterns [7], establishes and maintains functional residual capacity, decreases upper airway resistance [8] and inflates collapsed alveoli [9]. Bubble Continuous Positive Airway Pressure (B-CPAP) is relatively inexpensive and can be easily taught therefore has the potential to be the optimal respiratory support device for neonates in developing countries. Therefore, the present study was undertaken to evaluate the safety of bubble Continuous Positive Airway Pressure in preterm neonates with respiratory distress.

## Material & methods

A Prospective study which was conducted on 50 preterm babies admitted in NICU of Rohilkhand Medical College & Hospital, Bareilly, requiring respiratory support for mild to moderate respiratory distress based on Downe's score and Silverman Anderson score, support was given with short nasal prongs connected to Fisher & Paykel B-CPAP. Surfactant was administered when required and monitoring was done clinically, with pulse oximetry, radiologically and with arterial blood gases. All Neonates fulfilling the inclusion criteria were admitted in the NICU over the study period of six months with informed written consent taken from the parents of the neonates and they were assured that patient's personal information would be kept safe and will only be used for research followed by a case sheet proforma which was prepared and all the data was recorded & entered in MS Excel spreadsheet and analyzed with appropriate statistical method – SPSS.

## Inclusion criteria

Babies with –

- <37 weeks of gestation.
- Mild to Moderate respiratory distress (Downe's score 3-6 and  $\text{FiO}_2$  requirement of less than 60%.
- Recurrent episodes of apnoea of prematurity (>2 in 12 hour not requiring resuscitation)
- Neonates with TTNB, MAS, Congenital Pneumonia.

## Exclusion criteria

Babies with -

- >37 weeks of gestation.
- RDS secondary to birth asphyxia.
- NEC, Encephalopathy, Air leaks, Pulmonary haemorrhage, PPHN.
- Major congenital anomaly (TOF, Cleft lip & Palate, CDH, Choanal atresia)
- Neonates requiring intubation at birth and severe cardiovascular instability.

## Results

- Mean gestational age enrolled was 32 to 34 weeks and weight was 1.600 kg.
- 30(60%) were males and 20(40%) were females.
- Of 50 preterm neonates mean Respiratory Rate was 74.66 breaths per min, heart rate was 153.48 beats per minutes.
- 32(64%) had nasal flaring and 46(92%) had subcostal retraction.
- Mean Silverman Anderson score was 4.88
- Mean PEEP was 5.44 cm of  $\text{H}_2\text{O}$  and Mean  $\text{FiO}_2$  was 55.6%
- Complications of B-CPAP occurred in 20(40%), Apnea – 2(4%), Nasal abrasion – 10(20%), Gastric distension – 4(8%), Feed intolerance – 2(4%), Shock – 2(4%)
- Most common indication of B-CPAP was RDS – 42(84%), Pneumonia – 3(6%), TTNB – 3(6%), MAS – 2(4%)
- Failure rate in RDS - 10(23.8%), Pneumonia – 1(33.33%), TTNB – 0(0%), MAS – 0(0%)
- Overall 39 out of 50 preterm neonates i.e. 78% were successfully weaned off from B-CPAP.
- B-CPAP failure rate was 22% and these neonates were shifted over to the mechanical ventilation.

- Major causes of B-CPAP failure was recurrent apnea, not maintaining  $\text{paO}_2 < 50$  mmhg on maximum acceptable settings, PEEP requirement >8 cm of  $\text{H}_2\text{O}$ ,  $\text{FiO}_2$  requirement >60%, Air leak on B-CPAP.

## Discussion

We evaluated the role of B-CPAP in the management of RDS in preterm neonate. In this study 11 out of 50 preterm neonates who were started on B-CPAP required mechanical ventilation of which 10 neonates were of RDS. So overall our survival rate was 78%, which is higher in respect to similar studies due to no incidence of septicemia and qualified paramedical staff. During the study period there was statistically significant reduction in the use of mechanical ventilation hence early use of B-CPAP in RDS decreases the incidence of mechanical ventilation, length of ventilation, incidence of pneumothorax and incidence of bronchopulmonary dysplasia. Complications on B-CPAP have not been found to severe, the most common was Nasal abrasion (20%), this is however less in regard to other similar studies as we in our setup used a moisturizer on nasal cannula and released the nasal cannula for 10 – 20 seconds after every 1 hour. We fed most of our babies on B-CPAP, however, 2(4%) had feed intolerance with increased gastric aspirates. In our study the resident doctors and nurses looking after neonates on B-CPAP were found to be positively inclined towards this modality of respiratory support in preterm neonates. We found that 100% of the staff felt that B-CPAP was easier to use and is more reliable because of the visualization of bubbles and they can safely start and maintain B-CPAP on their own with minimal training.

## Conclusion

Use of B-CPAP in preterm neonates is safe, competent, easy to use, cheaper and results in decreased requirement of mechanical ventilation if started at appropriate time with mild to moderate respiratory distress in preterm neonates.

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