International Journal of Medical and Health Research
ISSN: 2454-9142
Received: 29-12-2018; Accepted: 31-01-2019
www.medicalsciencejournal.com
Volume 5; Issue 2; February 2019; Page No. 94-97

The study of outcome of indigenous bubble CPAP in neonates with respiratory distress

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Abstract
Respiratory distress is one of the most common reasons a neonate is admitted to the neonatal intensive care unit. And in resource poor settings there are higher rates of mortality and morbidity due to the lack of ventilation facilities.so this study aims in understanding the effectiveness of indiginenous bubble CPAP in neonates with respiratory distress.
Materials and Method: Neonates will be selected on the basis of inclusion and exclusion criteria. The parity and age of mother of the newborns with respiratory distress will be noted and analysed. Gender and the birth weight of every selected baby will be recorded. The cause of respiratory distress will be made by clinical examination and further investigations.
Conclusion: Indigenous Bubble CPAP, thus, may be considered as a primary mode of respiratory support in resource poor settings. It is an effective way of improving oxygenation and also reduces the complications, hospital stay and the need for mechanical ventilation.

Keywords: indigenous, respiratory, mechanical, CPAP

Introduction

Bubble CPAP is a non-invasive ventilation strategy for newborns with infant respiratory distress syndrome (IRDS). It is one of the methods by which continuous positive airway pressure (CPAP) is delivered to a spontaneously breathing newborn to maintain lung volumes during expiration. With this method, blended and humidified oxygen is delivered via short binasal prongs or a nasal mask and pressure in the circuit is maintained by immersing the distal end of the expiratory tubing in water. The depth to which the tubing is immersed underwater determines the pressure generated in the airways of the infant. As the gas flows through the system, It “bubbles” out and prevents buildup of excess pressures.

Bubble CPAP is appealing because of its simplicity and low cost. It is also associated with a decreased incidence of bronchopulmonary dysplasia (BPD) compared to mechanical ventilation. Not all infants with IRDS are candidates for initial treatment with CPAP and not all those who are given CPAP can be successfully managed with this modality.

CPAP is an “open-lung approach” used to manage newborn infants predisposed to developing airway instability, edema, and atelactasis. The clinical goals of CPAP are to maintain the functional residual capacity of the lungs and support gas exchange to reduce apnea, work of breathing, and lung injury. It is less expensive, easier to operate, poses potentially fewer risks, and requires less training than does intubation and subsequent conventional mechanical ventilation. Early bubble CPAP reduced intubations, days on mechanical ventilation, with no increased complications. Early CPAP an alternative to intubation and surfactant in preterm infants. Due to paucity of data and fewer studies done in tertiary care hospitals in this part of the country, I intend to do a study of Indigenous Bubble CPAP in newborns admitted to our nicu.

Aims and Objectives

- Study of BCPAP in newborns in terms of effectiveness, mortality morbidity, outcomes in NICU.
- To study the complications of bubble cpap

Materials and Method

Source of Data

New born babies who were on BCPAP admitted to NICU, department of Pediatrics, Krishna Hospital, Karad during the study period of October 2016 to march 2018.

Study design

Observational cross sectional study

Sample size: 50

Inclusion Criteria

All new born babies those who are on BCPAP including like

1. Respiratory distress syndrome.
2. Transient tachypnea of the newborn.
3. Meconium aspiration syndrome.
4. Primary pulmonary hypertension.
5. Pulmonary hemorrhage.
6. Patent ductus arteriosus
7. Apnea of prematurity.

Exclusion criteria

a. Recurrent apneic episodes not responding to BCPAP
b. Upper airway abnormalities like
    1. Cleft palate.
    2. Choanal atresia.
    3. Tracheoesophageal fistula.

c. Severe cardiovascular instability.
d. Severe ventilatory impairement (pH<7.25 and Paco2 >60mm Hg)

Observations and Results

34 (68%) and 16 (32%) mothers were primigravida and multigravida respectively.

Table 1: Distribution of mothers according to Parity

Parity	N	%
Primigravida	34	68%
Multigravida	16	32%
Total	50	100%

The incidence of male and female neonates was 33 (66%) and 17 (34%) respectively.

Table 2: Gender of Neonates

Gender	N	%
Male	33	66%
Female	17	34%
Total	50	100%

8 (16%) neonates weighed <1 kg while 12 (24%) and 20 (40%) neonates weighed in the range of 1.001– 1.499 kgs and 1.500 – 2.499 kgs respectively. 10 (20%) neonates weighed in the range of >2.5 kgs.

Table 3: Birth Weight of Neonates

Birth Weight (kgs)	N	%
≤1.000	8	16%
1.001 – 1.499	12	24%
1.500 – 2.499	20	40%
>2.500	10	20%
Total	50	100%

Diagnosis of 19 (38%) neonates was Respiratory distress syndrome while diagnosis of 12 (24%) and 8 (16%) neonates was Transient tachypnea of the newborn and Primary pulmonary hypertension respectively. The diagnosis in 7 (14%) and 4 (8%) neonates was Pneumonia and Meconium aspiration syndrome respectively.

Table 4: Distribution of neonates according to Diagnosis

Diagnosis	N	%
Respiratory distress syndrome (RDS)	19	38%
Transient tachypnea of the newborn (TTN)	12	24%
Primary pulmonary hypertension	8	16%
Pneumonia	7	14%
Meconium aspiration syndrome (MAS)	4	8%
Total	50	100%

There was significant increase in Arterial Blood Gas (ABG) parameters (pH, PaO2, HCO3 and BE) after 48 hours of intervention as per Student t-test (p<0.05).

Table 5: Comparison of ABG Parameters of neonates (who did not require mechanical ventilator) at different time periods

Parameters	Baseline		48 h	ours	p
	Mean	SD	Mean	SD	Value
pH	7.29	0.90	7.43	1.29	<0.05
PaCO2 (mmHg)	46.15	15.11	38.65	7.28	<0.05
PaO2 (mmHg)	44.16	5.99	86.44	6.88	<0.05
HCO3 (mEq/L)	14.81	3.37	23.26	3.39	<0.05
BE (mEq/L)	-10.65	1.29	-7.55	1.18	<0.05

The most common complication was nasal septal injuries (20%) followed by gastic distension (12%), pneumothorax (8%), sepsis (6%) and pneumonia (2%).

Table 6: Distribution of neonates according to Complications

Complications	N	%
Nasal septal injuries	10	20%
Gastric distension	6	12%
Pneumothorax	4	8%
Sepsis	3	6%
Pneumonia	1	2%

1. 35 (70%) mothers delivered by LSCS while 15 (30%) mothers delivered by normal delivery.
2. Maximum cases were at >36 weeks of gestation (96%) followed by ≤36 weeks of gestation (4%).
3. It was observed that 10 (20%) neonates required mechanical ventilation.
4. 3 (30%) neonates each with Respiratory distress syndrome (RDS) and Transient tachypnea of the newborn (TTN) required mechanical ventilator while 2 (20%) noenoates with Primary pulmonary hypertension required mechanical ventilator. 1 (10%) neonate each Pneumonia and Meconium aspiration syndrome (MAS) required mechanical ventilator.
5. 10 (20%) neonates required mechanical ventilation while 8 (16%) neonates required surfactant. 46 (92%) neonates survived and were discharged while 4 (8%) neonates in the study group died.
6. After observation for 6-8 hours,10 neonates out of 50 required mechanical ventilation as respiratory distress and tachypnea was not responding to BCPAP.
7. It was observed that duration of BCPAP in 18 (36%) neonates that did not require Mechanical Ventilation was 24-32 hours while it was 32-72 hours and >72 hours in 12 (24%) and 10 (20%) neonates respectively. Pressure was initially set at 5 cmH_2O, gradually reduced to 4 cmH_2O and then weaned off to plain O_2.
8. 2 (50%) neonates with Respiratory distress syndrome (RDS) died while 1 (25%) neonate each with Transient tachypnea of the newborn (TTN) and Primary pulmonary hypertension died.
9. It was observed that 7 (14%) and 3 (6%) male and female neonates respectively required mechanical ventilator. There was no significant
10. association of requirement of mechanical ventilator and gender of neonates as per Chi-Square test (p>0.05).
11. 5 (10%) and 3 (6%) neonates that weighed in the range of 1.500 –2.499 kgs and 1.001 – 1.499 kgs respectively required mechanical ventilation while 1 (2%) neonate each that weighed <1 kg and >2.5 kgs required mechanical ventilation. There was no significant association of requirement of mechanical ventilator and birth weight of neonates as per Chi-Square test (p>0.05).

Discussion

In the present study, majority of the mothers (54%) were in the age group of 26-35 years followed by 42% in the age group of 18-25 years and 4% in the age group of
>35 years. 35 (70%) mothers delivered by LSCS while 15

(30%) mothers delivered by normal delivery. This is similar to the study of Sunil B *et al.* [1]. In our study, 34 (68%) and 16 (32%) mothers were primigravida and multigravida respectively. Maximum cases were at >36 weeks of gestation (96%) followed by ≤36 weeks of gestation (4%). This is comparable to the study of Saha LC *et al.* [2].

It was observed in our study that diagnosis of 19 (38%) neonates was Respiratory distress syndrome while diagnosis of 12 (24%) and 8 (16%) neonates was Transient tachypnea of the newborn and Primary pulmonary hypertension respectively. The diagnosis in 7 (14%) and 4 (8%) neonates was Pneumonia and Meconium aspiration syndrome respectively. The baseline Arterial Blood Gas (ABG) parameters of neonates are characterised as Arterial blood 7.29±0.90pH, Partial pressure of carbon dioxide (PaCO2) 46.15±15.11mmHg, Partial pressure of oxygen (PaO2) 44.16±5.99mmHg, Bicarbonate (HCO3) 14.81±3.37mEq/L and Base Excess (BE) -10.65±1.29mEq/L respectively. This is consistent with the study was Mathai SS *et al.* [3].

It was observed in our study that 10 (20%) neonates required mechanical ventilation. Sunil B *et al.* [1] noted similar observation in their study.

In the present study, 3 (30%) neonates each with Respiratory distress syndrome (RDS) and Transient tachypnea of the newborn (TTN) required

Mechanical ventilator while 2 (20%) noenoates with Primary pulmonary hypertension required mechanical ventilator. 1 (10%) neonate each Pneumonia and Meconium aspiration syndrome (MAS) required mechanical ventilator. Similar observations were noted in the studies of Sunil B *et al.* [4], Sauparna C *et al.* [4], Saha LC *et al.* [2] and Koti J *et al.* [5].

In our study, there was significant increase in Arterial Blood Gas (ABG) parameters (Ph, PaO2, HCO3 and BE) after 48 hours of intervention as per Student t-test ($p<0.05$). This is in concordance to the studies of Saha LC *et al.* [2] and De Klerk *et al.* [6].

The most common complication in the present study was nasal septal injuries (20%) followed by gastic distension (12%), pneumothorax (8%), sepsis (6%) and pneumonia (2%). These findings were consistent with the studies of Saha LC *et al.* [2] and Mathai SS *et al.* [3].

In our study, 10 (20%) neonates required mechanical ventilation while 8 (16%) neonates required surfactant. 46 (92%) neonates survived and were discharged while 4 (8%) neonates in the study group died.After observation for 8-10 hours, the neonates required mechanical ventilation as respiratory distress and tachypnea was not responding to BCPAP. It was observed that duration of BCPAP in 18 (36%) neonates that did not require Mechanical Ventilation was 24-32 hours while it was 32-72 hours and >72 hours in 12 (24%) and 10 (20%) neonates respectively. Pressure was initially set at 5 cmH_2O, gradually reduced to 4 cmH_2O and then weaned off to plain O_2. This is consistent with the studies of Koti J *et al.* [5] and Sunil B *et al.* [1].

In the present study, 2 (50%) neonates with Respiratory distress syndrome (RDS) died while 1 (25%) neonate each with Transient tachypnea of the newborn (TTN) and Primary pulmonary hypertension died.

It was observed in our study that 7 (14%) and 3 (6%) male and female neonates respectively required mechanical ventilator. There was no significant association of requirement of mechanical ventilator and gender of neonates as per Chi-Square test (p>0.05).5 (10%) and 3 (6%) neonates that weighed in the range of 1.500 – 2.499 kgs and 1.001 – 1.499 kgs respectively required mechanical ventilation while 1 (2%) neonate each that weighed <1 kg and >2.5 kgs required mechanical ventilation. There was no significant association of requirement of mechanical ventilator and birth weight of neonates as per Chi-Square test (p>0.05). This is similar to the studies of Ammari A *et al.*, Saha LC *et al.* [2], Sunil B *et al.* [1], Kishore M *et al.* [8], Ho JJ *et al.* [9] and Finer NN *et al.* [10].

Conclusion

Establishing a NICU with mechanical ventilation would require high level of expertise and trained personnel, which is far from reality in many of the peripheral and district hospitals in our country. The importance of BCPAP in the absence of neonatal intensive care improves outcome in neonates treated with BCPAP prior to transfer to a tertiary unit. Bubble CPAP, thus, may be considered as a primary mode of respiratory support in resource poor settings. Bubble CPAP is an effective way of improving oxygenation (e.g: O2 saturation and PH, PCO2, PO2 and BE) of preterm LBW babies and term babies with respiratory distress due to various causes. BCPAP use reduces the complications, hospital stay and the need for mechanical ventilation.

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