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Pediatrics

USE OF EARLY LABOUR ROOM BUBBLE CPAP IN PRETERMS BORN AT 28-32 WEEKS OF GESTATION

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ABSTRACT

OBJECTIVE: To study the use of early labour room Bubble CPAP in preterm neonates born at 28-32 weeks of gestation and to analyse the outcome in relation to need for mechanical ventilation, duration of hospital stay and mortality at the Neonatal Intensive Care Unit (NICU), Tertiary Care Teaching Government Hospital Kurnool, Andhra Pradesh for a period of 1 Year.

METHODS : Facility Based Interventional Studied (Randomised Control Study)

Participants : Study sample of 109 preterm babies of age 28-32 weeks of gestation

CASES : 54 cases, neonates with respiratory distress who were started on CPAP in the labour room within 15 minutes of life.

Controls : 55 babies, neonates with respiratory distress who were started on CPAP after 15 minutes to 6 hours of life.

In the present study, both the groups (cases and controls) were monitored till they were discharged and the need for mechanical ventilation was noted. Clinical diagnosis of RDS was made based on the time of onset of respiratory distress and clinical examination and respiratory scoring (Silverman Anderson Score) . Chest X-ray and routine investigations were done in all neonates. Duration of CPAP and difference in mortality between the two groups was analysed.

OUTCOME : In the present study, preterm neonates born at 28-32 weeks of gestation who were started on early labour room CPAP vs control group outcome is assessed in relation to need for mechanical ventilation and duration of hospital stay and mortality.

Results: It is observed that 16 (29.63%) cases required mechanical ventilation whereas 28 (50.91%) preterm neonates in the control group needed mechanical ventilation. There was a statistically significant difference between the two groups ($p < 0.05$).

The duration of stay in NICU in neonates with early CPAP was significantly less when compared to the controlled group. 30(76.9%) neonates were discharged within 14 days among cases and 16 (48.48%) neonates among control group.

There is no difference in mortality between the 2 groups.

CONCLUSIONS : The following conclusions could be drawn out of the present study on preterm neonates.

1. The early administration of CPAP in the delivery room in preterm neonates developing respiratory distress decreases the need for mechanical ventilation.
2. The duration of stay in NICU in neonates with early CPAP was significantly less.
3. There is no difference in mortality between the two groups.

KEYWORDS : Bubble CPAP, Preterm neonates ,Functional Residual Capacity , Respiratory Distress Syndrome

INTRODUCTION

Respiratory Distress Syndrome is a clinical syndrome characterised by respiratory failure in a preterm neonate. The immature lung in RDS is deficient in surfactant and is prone to atelectasis which in turn leads to lung inflammation and poor gas exchange. CPAP refers to the application of positive pressure to the airway of a spontaneously breathing infant through out the respiratory cycle. CPAP predominantly helps by preventing collapse of the alveoli with marginal stability. This results in better recruitment of alveoli thus increasing the Functional Residual Capacity.

Limited facilities exist at rural hospitals for the management of newborn infants with Respiratory Distress Syndrome. Furthermore the secondary and tertiary hospitals are under severe stress to accept all the referrals from rural hospitals. Introduction of labour room CPAP at all facility levels (delivery rooms) reduces the incidence of RDS and reduces the referrals to secondary and tertiary care hospitals.

CPAP is often thought to be the 'missing link' between supplemental oxygen and mechanical ventilation. The first clinical use of CPAP was reported by Gregory et al in a land mark report in 1971.

Patient interfaces : The devices used for CPAP delivery include:

a. Nasal prongs - single or double
b. Long (or) nasopharyngeal prongs
c. Nasal masks

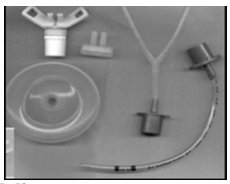

FIGURE 1: CPAP delivery systems

Clinical indications for CPAP

1. Respiratory distress syndrome (RDS)
2. Apnea of prematurity (especially obstructive apnea)
3. Post-extubation in preterm VLBW infants
4. Transient tachypnea of newborn (TTNB) / delayed adaptation
5. Pneumonia
6. Meconium aspiration/ other aspiration syndromes
7. Pulmonary edema/pulmonary hemorrhage
8. Laryngomalacia / tracheomalacia / bronchomalacia

DELIVERY ROOM CPAP :

Bubble CPAP is a low cost nasal delivery CPAP system where the expiratory arm of the system ends submerged under the desired centimetres of water which supplies the desired cm H2O PEEP. Recently CPAP has been used to stabilize neonates immediately after resuscitation in the delivery room. CPAP was associated with almost 50% reduction in need for intubation and mechanical ventilation, and surfactant usage in comparison to 'mechanical ventilation with or without surfactant.

MATERIALS AND METHODS:

The study population included preterm neonates admitted to the NICU with respiratory distress within 6 hours of life. They were categorized into case and control groups. Cases included neonates with respiratory distress who were started on CPAP in the labour room within 15 minutes of life. Control group included neonates with respiratory distress who were started on CPAP after 15 minutes to 6 hours of life.

Clinical diagnosis was made based on time of onset of respiratory distress and clinical examination and respiratory scoring (Silverman Anderson score). Then chest X-ray and routine investigations were done in all neonates. Duration of CPAP between the study and control groups was noted. Both the groups were monitored till they were

discharged and the need for mechanical ventilation was noted.

Silverman Scoring System

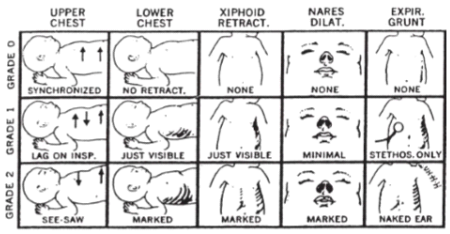

FIGURE 2: Silverman Anderson Scoring System

INCLUSION CRITERIA :

All preterm neonates of gestaional age 28 – 32 weeks admitted in NICU with respiratory distress less than 6 hours.

All preterm neonates of gestational age 28 – 32 weeks developing respiratory distress immediately after birth in delivery room

EXCLUSION CRITERIA:

Neonates with congenital malformations.

Neonates requiring mechanical ventilation at the time of admission and at birth.

STATISTICALANALYSIS :

The present interventional study was conducted in the neonatal intensive care unit (NICU) Government General Hospital(GGH) Kurnool for a period of 1 year. A total of 3034 babies were admitted to NICU during the study period, out of which 1551 were LBW babies. Of which babies with gestational age 28-32 weeks were 421 babies were included in the study after exclusion, out of which 54 babies were included in the study group and 55 in the control group.

TABLE 1: Distribution according to birth weight among cases and Controls.

BIRTH WEIGHT(Gms)	CASES	CONTROLS
<1000	5(9.25%)	9(16.36%)
1000-1250	25(46.30%)	22(40%)
>1250	24(44.45%)	24(43.64%)
TOTAL	54(100%)	55(100%)

Most of the babies in the study & control group fell under the weight group of 1000-1250 gms constituting 25(46.30%) in cases and 22(40%) in control group. There were 24(44.45%) babies more than 1250 gms in cases and 24(43.64%) in controls. There was no statistically significant difference between the two groups.

TABLE 2: Distribution according to respiratory rate among cases and controls

RR(respiratory rate)	CASES	CONTROLS
60-80	44(81.48%)	40(72.72%)
>80	10(18.52%)	15(27.27%)
TOTAL	54(100%)	55(100%)

Respiratory rate is taken as an important parameter for diagnosis of Respiratory Distress Syndrome in newborn. 44(81.48%) of the preterms among the cases had the respiratory rate between 60-80 / minute. Only 10(18.52%) among the cases had their respiratory rate more than 80 per minute.

TABLE 3 : Distribution according to respiratory score among cases and controls

RESP SCORE	CASES	CONTROLS
5	20(37.03%)	9(16.36%)
6	26(48.16%)	40(72.73%)
7	8(14.81%)	6(10.91%)
TOTAL	54(100%)	55(100%)

The more severe form of respiratory distress with respiratory score of 7 was seen more in cases, 14.81% vs 10.91% in controls. Moderately severe respiratory distress with calculated score of 6 was observed more in controls, 72.73% vs 48.16% in cases. Less severe respiratory distress with calculated score of 5 was observed more in cases 37.03% vs 16.36% in controls.

In our study, severity of respiratory distress did not directly correlate with the time of onset of respiratory distress.

TABLE 4: Distribution according to need for mechanical ventilation among cases and controls

NEED FOR MECH . VENTILATION	CASES	CONTROLS
YES	16(29.63%)	28(50.91%)
NO	38(70.37%)	27(49.09%)
TOTAL	54(100%)	55(100%)

From the above table it is observed that 16(29.63%) cases required mechanical ventilation. Whereas 28(50.91) preterms in the controls needed mechanical ventilation. Indicating early initiation of CPAP in the premature babies at delivery room will reduce the need of the mechanical ventilation and prolonged hospital stay on mechanical ventilation. There was a statistically significant difference between the two groups($p<0.05$)

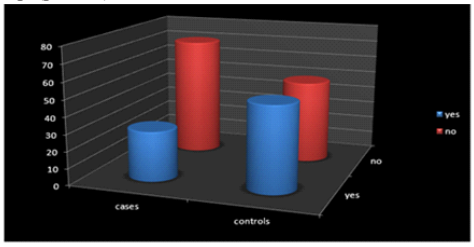

Figure: 3 Need For Mechanical Ventilation Distribution Among Cases And Controls

TABLE 5: Distribution according to duration of stay in NICU among cases and controls

DURATION OF STAY(DAYS)	CASES	CONTROLS
1-14	30	16
15-21	8	15
>21	1	2

The duration of stay in NICU in neonates with early CPAP was significantly less when compared to the control group. 30 neonates were discharged with in 14 days among cases and 16 neonates among control groups. 8 neonates stayed in NICU between 15 – 21 days and 15 neonates in control group. 1 neonate stayed beyond 21 days from cases group and 2 neonates from control group

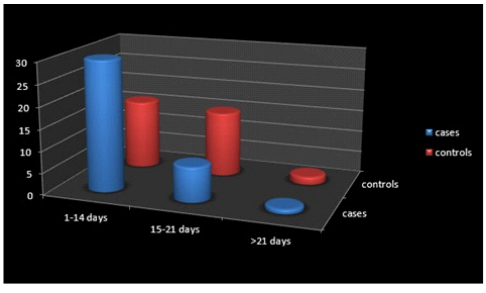

FIGURE: 4 DURATION OF STAY IN NICU DISTRIBUTION AMONG CASES AND CONTROLS

TABLE 6 : Distribution according to mortality among cases and controls

	CASES	CONTROLS
SURVIVAL	39(72.22%)	35(63.64%)
DEATHS	15(27.78%)	20(36.36%)
TOTAL	54(100%)	55(100%)

In the present study 15(27.78%) preterms died due to various causes in the study group and 20(36.36%) preterms died in control group. There was no statistically significant difference between the two groups. Thus early initiation of CPAP does not have any impact on mortality

DISCUSSION :

CPAP has been used primarily to treat surfactant deficiency in preterm infants for many years (1). Particular interest in CPAP focuses on its potential role to reduce ventilator-induced lung injury and BPD. The mechanisms responsible for the possible effects of CPAP to decrease BPD have not yet been evaluated. One postulated mechanism is the

avoidance of aggressive initiation of intermittent positive pressure ventilation and inadvertent hyperventilation/under ventilation that occurs in ventilated infants (6). CPAP also protects the airway from mechanical injury and bacterial colonization related to the endotracheal tube. CPAP putatively increases both functional residual capacity and endogenous respiratory drive leading to decreased delivery room intubations, reintubations and days on mechanical ventilation (7). CPAP has been associated with decreased BPD in several clinical reports (3,8,9,10).

There are practical concerns regarding the implementation of early CPAP in the delivery room. Preterm infants allowed to breath spontaneously with nasal prongs will not 'pink up' as rapidly and PCO2 values will be higher than tolerated. Secondly, the safety of permissive hypercapnia has to be accepted (11), although high PCO2 levels may decrease lung injury (12). Safe upper values for PCO2 have not been determined for preterm infants (13). Thirdly, the prolonged use of CPAP delivered by nasal prongs can lead to nasal septal erosions and abnormal head moulding that can complicate clinical outcome.

In the present study, there is no statistically significant difference in study vs control group in relation with birth weight and gestational age ($p > 0.05$). Similar results were obtained in the study conducted by Mohammed H. Bahbaha et al (14).

When associated risk factors are analyzed, PIH was found to be the predominant risk factor for premature deliveries in 57.75%, followed by hydromnios 35.7% and multiple gestation 9%. This is comparable with the Mohammed H.Bahbaha, Hanaa A et al (14) study with17.5% babies associated with maternal risk factor being PIH.

In the present study among 109 infants assigned to study group (n=54) and control group (n=55), the need for mechanical ventilation is significantly lower in study group(29.63% vs 50.91%) $p = 0.023$ as compared to the results obtained in the study conducted by Booth et al.(2006) which showed the use of early CPAP led to a decrease in the need for mechanical ventilation (MV) (15) .

When compared to historical controls, the number of infants ventilated (65 vs 14%), Ho JJ, Henderson, Davis (2002) showed the early use of CPAP decreased the use of subsequent positive pressure ventilation (16). Similar results were also seen in a study conducted by Millet V et al (17) on early continuous positive pressure in the labour room which showed that the need for subsequent ventilation was reduced to 40% of population.

The duration of stay in NICU in neonates with early CPAP was significantly less when compared to the control group. 30 neonates were discharged within 14 days among cases and 16 neonates among control groups . 8 neonates stayed in NICU between 15 – 21 days and 15 neonates in control group. The results were statistically significant ($P < 0.05$). Upadhyay and colleagues stated that mechanically ventilated patients usually have more severe clinical states and need more time for weaning as they are exposed to more complications (18) .

We found that early bubble CPAP when begun in the delivery room was safe, inexpensive and an effective way to avoid intubations in the delivery room. There is growing evidence to indicate that early CPAP from birth is feasible and safe in preterm infants. The use of CPAP was able to help in the establishment and maintenance of functional residual capacity (Gregory et al. 1971).

CONCLUSIONS:

The need for mechanical ventilation is 29.63% in study group and 50.91% in control group and this shows the early administration of CPAP in the delivery room in preterm neonates developing respiratory distress decreases the need for mechanical ventilation there by reducing the financial burden and also complications related to invasive ventilation.

The duration of stay in NICU in neonates with early CPAP was significantly less when compared to the control group. This indicates early administration of CPAP helps in early discharge from hospital and early recovery.

There is no difference in mortality between the two groups indicating there is no significant impact of early labour room CPAP on mortality.

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