ORIGINAL RESEARCH

Outcome Of Neonates With Respiratory Distress On Indigenous Bubble CPAP

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ABSTRACT

Introduction: Respiratory distress remains one of the most common cause of neonatal death in thedeveloping world . The respiratory support in the form of Continuous Positive Airway Pressure (CPAP) ormechanical ventilation is provided to the neonates during distress. Bubble CPAP is an important, simple,non-invasive, and cost effective treatment modality for respiratory distress in neonate. **Objective**: To as certain the outcome of neonates with respiratory distress on bubble CPAP and identify risk factors associated with its failure. **Methods**: This observational study was conducted in SNCU of the tertiarycare center of central India, over the duration of 18 months enrolling 215 neonates .All the neonates who had SAS/DOWNES≥4 were included. Data was compiled using MS EXCEL and analyzed using IBMSPSS20. **Result:** The Gestational age and Birth weight was 34-36weeks and 1.5-2.0kg respectively. The most common cause of starting BCPAP was RDS 121(56.3%) followed by, Birth asphyxia70 (32.6%),MAS 25(11.6%) and TTNB15(7.0%). The common complication on BCPAP was Nasal damage55(25.6%).Overall failure rate was 114 (53%). Eighty three (72.8%) failure was seen in Respiratory Distress Syndrome group followed byPerinatal asphyxia23(20.1%), Meconium Aspiration Syndrome 16(14%) and Transient Tachypnea of Newborn 2(1.7%). All babies who failed on BCPAPwereputon mechanical ventilation .CPAPFailurerate washigherinneonates who hadsepsis andshock**Conclusion:** Indigenous Bubble CPAP may be considered as a primary mode of respiratory support inmild respiratory distress in resource poor settings. It is an effective way of improving oxygenation inneonateswithmild respiratory distress.

Keywords: BubbleContinuous Positive Airway pressure,RespiratoryDistress,Neonates.

INTRODUCTION

Respiratory distress is the most common condition which leads to Neonatal admission to the Specialnewborn care unit. The incidence of Respiratory distress is 6.7% in India .The leading cause of Respiratory Distress isTransient Tachypnea of Newborn{TTN} (42.7%) followed by infections (17.0%), Meconium Aspiration Syndrome {MAS}(10.7%), Respiratory Distress Syndrome {RDS}(9.3%) and Birth Asphyxia(3.3%) [1]. Preterm had highest incidence of Respiratory distress. BCPAP is an important treatment modality for respiratory distress in neonates. It can be applied via a facemask, nasopharyngeal tube or nasal prongs, using a conventional ventilator, bubble circuit or a CPAP driver[2] .Geogory et al first pioneered the use of Bubble CPAP in Neonatology which was published in70s in Columbia [3]. BCPAP is one of the low cost nasal oxygen delivering system in which increasedpulmonary pressure is provided artificially during both phases of breathing in spontaneously breathingneonates to prevents alveolar collapse and ensures gas exchange throughout the respiratory cycle. Thisstudy was planned to look at the effectiveness of BCPAP in reducing mortality and need for invasiveventilationand its safetyasa form of respiratory support in limited resource settings.

METHODS

This observational cross sectional study was conducted at tertiary care Special Newborn Care Unit(SNCU) after obtaining approval from the institutional ethical committee .All neonates admitted duringthe study period of 18 months (from March 2021 to September 2022) who were fulfilling the inclusioncriteriaas:Allnewbornsabove1000gramsofbirthweightdevelopingrespiratorydistresswithin24hrsoflife were included and those with respiratory distress secondary to congenital pneumonia, necrotizing enterocolitis and any major congenital malformation were excluded from the study. Those babies who had DOWNE'S/Silvermann Anderson Score(SAS) >6were directly puton ventilator. After taking informed consent from parents of newborns,

demographic data, age at admission, gender, risk factors in pregnancy ,type of delivery, details of birth history ,diagnosis , and need for resuscitation and distress level were recorded at the admission in a predesigned proforma. All subjects included in the studywere screened daily for Respiratory distress using DOWNE's Score for term and SAS for preterm newborns. They were nursed under radiant warmers and treated according toSNCU protocol. Newborns who had SAS/DOWNE's score ≥4 were started on BCPAP with 5cmH2O and Fio2 adjusted to maintain pulseoximeter saturations between 88% to 94% in <1.5kg and 92% to 94% in>1.5kg babies[4].

Procedure of making BCPAP in our department: A pressurized oxygen is delivered to nasopharynx of the baby. An under water "T tube "that acts as ablow off valve is interposed between the oxygen source and the baby, the pressure in the system and CPAP delivered to the baby can be regulated by adjusting the height of the water column above the exit of the 'Ttube'. The constant bubbling of gas through the blow off mechanism delivers the bubbling CPAP effect.

BCPAP was started on the basis of clinical assessment of the baby and included any baby with the following[4]:

- Presence of respiratory distress as assessed by Downe's for term and Silvermann Andersons scoring for preterm neonates.
- Requiring oxygen >30% to maintain saturation within target range
- Presence of cyanosisan HR, RR, blood pressure and Spo2) was done every 4 hourly, position change and suctioning was done and water in the bottle changed every 4 to 6hours[5]. Weaning off from BCPAP was done when respiratory distress decreased to DOWNE'S and SASscore

Failure of B-CPAP was defined as:

1. FiO2 requirement>0.6
2. Pressure requirement >8cm H2O3. Pao2<50mmHg on optimal settings
3. PaCo2>60mmHgandPH<7.25onoptimalsettings5. AirleaksonB-CPAP
4. Recurrentapneaon BCPAPdespitecaffeine citrate.

Statistical analysis: The collected data were transformed into variables, coded and entered in Microsoft Excel. Data were analyzed and statistically evaluated using IBMSPSS Version 20.0.0.0. Descriptive Statistics was presented in the form of numbers and percentages. Association between two non-parametric variables was evaluated using Pearson Chi-square test. A p value of <0.05 was taken as statistically significant.

RESULTS

We included a total of 215 neonates out of which 47% were weaned off from BCPAP successfully andrest were switched to either Machine CPAP/Ventilator CPAP or Intubated and were considered in failure group. Mean gestational age of newborns in our study was 35.05+_ 2.26weeks; mean birth weight was 2.08+_0600grams. The most common cause of Respiratory distress for initiating BCPAP was RDS 122 (56.7 %) followed by Birth asphyxia 70 (32.6%), Meconium aspiration syndrome 25(11.6 %) and Transient tachypneaofnewborn 15 (7%). Very Low Birth Weight(VLBW) neonates were 38 (17.7%)in number and failure rewas highest in these babies.The commonest complication seenon indigenous BCPAP was nasal damage where as babies who failed on indigenous BCPAP were mostly having sepsis, shock, DIC and pulmonary hemorrhage. The failure on BCPAP was 114 (53%), out of them 83 (72.8%) were in RDS groups, 23(20.1%) birth asphyxia ,16 (14%)MAS and 2 (1.7%) was in TTNB. Maternal complications which influenced the respiratory distress most is Pregnancy Induced Hypertension followedby gestational diabetes mellitus, Fetal Mal presentation and Prolonged labour. Neonates who failed on Indigenous BCPAP were initiated either on conventional MCPAP/VCPAP or mechanical ventilation.

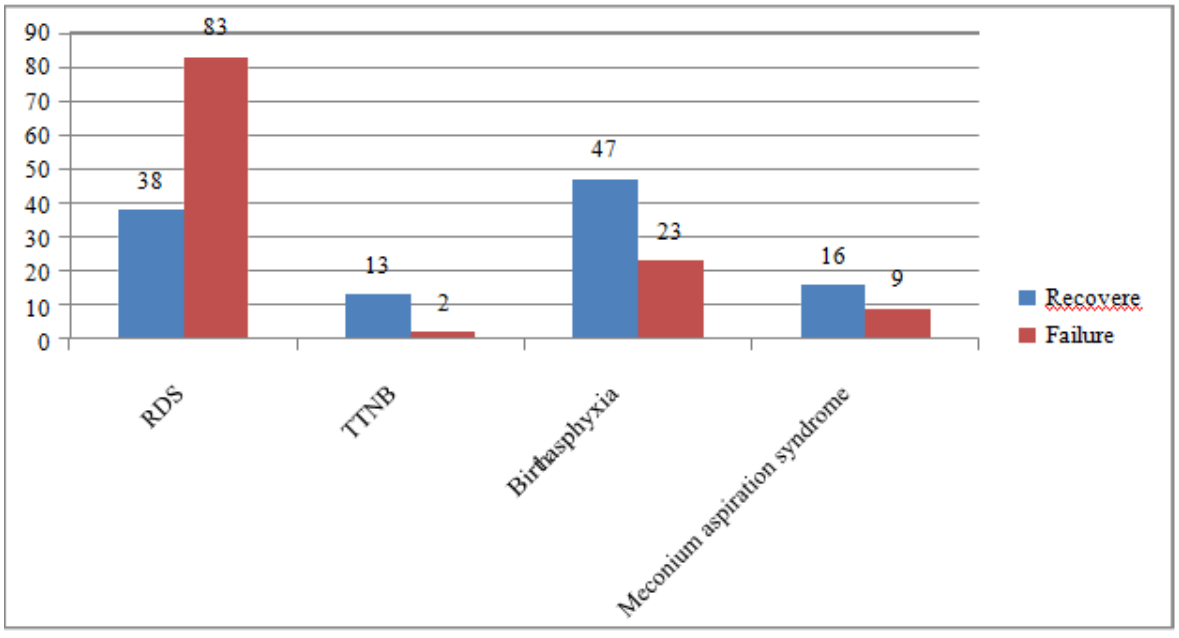
Table 1: Distribution of neonates according to Gestational Age andBirthweight

Variables	Final Outcome		Total	χ2 value, df	P value
	Failure	Recovered			
Gestational age:					
30-32 weeks	34 87.2%	5 12.8%	39 100.0%		
32-34 weeks	35 66.0%	18 34.0%	53 100.0%	35.735, df=3	0.001*
34-36 weeks	24 33.8%	47 66.2%	71 100.0%		
>36 weeks	21 40.4%	31 59.6%	31 59.6%		
Birth Weight:					
1-1.5 kg	35	3	38		

Variables	Final Outcome		Total	χ2 value, df	P value
	Failure	Recovered			
	92.1%	7.9%	100.0%		
1.5-2.0 kg	51 54.8%	42 45.2%	93 100.0%	39.934, df=5	0.001*
2.0-2.5 kg	10 32.3%	21 67.7%	31 100.0%		
2.5-3.0 kg	9 30.0%	21 70.0%	30 100.0%		
3.0-3.5 kg	9 47.4%	10 52.6%	19 100.0%		
3.5-4.0 kg	0 0.0%	4 100.0%	4 100.0%		

Table 2:ComplicationofNeonates on BCPAP

Neonatalcomplications	Frequency(N)	Percentage(%)
Sepsis	122	56.7
Shock	93	43.3
Nasaldamage	12	5.5
Disseminatedintravascularcoagulopathy	23	10.7
Pulmonaryhemorrhage	15	7.0



DISCUSSION

In our study Indigenous BCPAP has been used as primary ventilation support for 215babies. Mean gestational age and mean birth weight in our study was 35.05±2.26wks , 2.08±0600grams respectively, which is not accordance with, Manar Al-lawama, Haitham Alkhatib et al(7) where it was 36±2.7weeks; and 2,770±1,800gms respectively. This study also took various factors into account which lead to failure of bubble CPAP therapy. In our study outcome of Indigenous bCPAP was affected by gender, whereas in Sandri, et al(8) have shown that male infants with RDS required higher assistance of respiratory support. It is seen that neonates born by mothers with complications like Preeclampsia 74 (34.4%), gestational diabetes mellitus in 28(13%), fetal mal-

presentation 27(12.6%) and prolonged labour10(4.7%) had more respiratory distress which were not mentioned in other studies. It is observed in our study that RDS was the most common cause of respiratory distress similar to other studies but was different from Manar Al-lawama, Haitham Alkhatib*et al (7)*where transient tachypnea of the new born (42%) was the most common presentation .According to our study Bubble CPAP was effective in treating only mild grade RDS similar to BOO et .al(9) study where moderate RDS was one of the cause of the failure of CPAP. With the least serious complications for the patient interface, nasal prongs are easiest to use.Dislodgementandnasalirritationwerethemostcom moncomplicationsseenwhileusing nasalprongs.In the final outcome we have seen that 101 (47%) neonates recovered, 114 (53.0%) neonates went intofailure and in failure category 76 (66.6%) neonates weaned off successfully and remaining38 (17.7%)neonates died.. Success rate in our study was 47% which was less than ManarA l-lawama, Haitham Alkhatib et all study(7) where it was 97%. 38% failed BCPAP in Gupta et al (10) studywhich was lower thanthatfound inourstudy 53%.The prevalence of failure was significantly higher in babies with respiratory distress syndrome (P<0.05); while the prevalence of failure was significantly lower in babies with TTNB andbirthasphyxia(P<0.05).Indevelopingcountriesduet opoorresourcesandhighadmissionloaditisnotpossiblet ohavemechanical ventilation and or MCPAP/VCPAP for every neonates with respiratory distress. Because ofsame problem we use BCPAP as our primary mode of ventilation when required. Lanieta, et al (11) havesuccessfully demonstrated the usefulness of BCPAP in a developing country, and have also reported thecost effectiveness with use of Bubble CPAP. Pieper,et al(12) have shown the importance of CPAP in theabsence of neonatal intensive care. BCPAP can be considered as primary mode of ventilation in poorsettings.

CONCLUSION

BCPAP is safe , effective and easy to use modality in preterm and term neonates with mild respiratorydistress.Use of indigenous BCPAP in low resource settings is boon to the current managementofnewbornswithrespiratorydistress.Its usein tertiarycare settingscan causelessreferrals andcansavelives of many newborns. The major factor which lead to failure was sepsis followed by shock in Indigenous BCPAP .

LIMITATION

The Limitation of thisstudywasthat we did notuse Humidifierinourcircuit whichaddsmoisture tothe airtoprevent dryness.

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