Original Research Article

Maternal and foetal risk factors predicting outcome of bubble CPAP in babies with respiratory distress

Shakira Savaskar[1], Suresh Narayan Singh[2*]

[1]Professor, Department of Pediatrics, Government Medical College, Solapur, Maharashtra, INDIA.
[2]PG, Department of Pediatrics, Government Medical College, Latur, Maharashtra, INDIA.
Email: snsingh3107@gmail.com

Abstract

Background: Respiratory distress is most common and serious complication in relation with various maternal and foetal risk factors, which together account for over one-half of all neonatal deaths globally. The respiratory support during distress is provided to neonates using either mechanical ventilation or Continuous Positive Airway Pressure (CPAP). **Aim and Objectives:** To study the maternal and foetal risk factors predicting outcome of Bubble CPAP in babies with respiratory distress **Material and Methods:** It's a prospective, observational type of study carried out on the babies requiring BCPAP at the time or during the hospital stay over a period of 2 years. The final outcome in terms of success and failure of BCPAP with regard to various maternal and foetal risk factors evaluated and compared. **Results:** Out of 1571 patients, a total of 748 (47.61%) required BCPAP. Maternal risk factors like antepartum hemorrahge, multiple gestation, prior preterm birth, premature rupture of membrane were associated were poor outcome while, pregnancy induced hypertension has relatively better outcome. Foetal risk factors like gender, gestational age and birth weight of newborn are associated with outcome of BCPAP. **Summary and conclusions:** BCPAP is increasingly used as a first choice for ventilator support in tertiary centres. It reduces morbidity and mortality, as well as the need for mechanical ventilation. It can be administered by trained nurses and is safer than mechanical ventilation.
Key Words: Respiratory distress, BCPAP.

[*]**Address for Correspondence:**
Dr. Suresh Narayan Singh, PG, Department of Pediatrics, Government Medical College, Latur, Maharashtra, INDIA.
Email: snsingh3107@gmail.com
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INTRODUCTION

Respiratory distress is most common and serious complication of preterm birth, neonatal pneumonia, and neonatal sepsis, which together account for over one-half of all neonatal deaths globally. More than 50% of babies born at ≤31 weeks of gestation will develop respiratory distress syndrome (RDS). Respiratory distress is associated with over 80% of cases of neonatal pneumonia and most cases of neonatal sepsis. In the developed world, respiratory support is provided to neonates using either mechanical ventilation or Continuous Positive Airway Pressure (CPAP). Unfortunately, ventilators and CPAP machines are too expensive and technically complex for many resource-limited settings. As a result, respiratory illness remains one of the most common causes of neonatal death in the developing world. India is home of 20% of global birth and to highest number of neonatal deaths in the world. Each year nearly 27 million infants are born in India of these 1.2 million die during neonatal period. CPAP is a gentle and effective tool to treat even preterm and low birth weight infants in respiratory distress.[1] Well-resourced hospitals use ventilators, stand-alone CPAP devices, or tubing, wall air and oxygen to set up CPAP at the bedside. Bubble CPAP has been used in developed countries for decades. In bubble CPAP (BCPAP), pressure is safely regulated which helps to recruit alveoli and increase functional residual lung capacity, thus lowering the baby's work of breathing.[2]

MATERIAL AND METHODS

The present study is a prospective, observational type of study. The study population included the babies requiring BCPAP at the time or during the hospital stay over a

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period of 2 years. The indigenous bubble CPAP assembled in the NICU using intercostal drainage bag, t piece connector, nasal prongs and oxygen source with humidifier.[3]All the babies meeting the inclusion criteria are kept on BCPAP and monitored. The final outcome in terms of success and failure are evaluated, as well as complications and reasons for failure were studied. The pressure of BCPAP is regulated by adding or removing the water from intercostal drainage bag. Once the score is less than 4 the babies are shifted to oxygen without CPAP. The study design and methodology of the present study was approved by the institutional ethical committee. The neonatal admissions consisting of all inborn neonates born in the tertiary care centre with the respiratory distress at the time of admission were included in the study. While, all those outborn neonates, inborn patients with respiratory distress not fitting into criteria to start BCPAP, patients with severe distress needing endotracheal intubation at the start and those babies who required surfactant were excluded from the study.

RESULTS AND OBSERVATIONS

Out of 1571 patients studied during a period of two years, a total of 748 (47.61%) required BCPAP while, 233 (14.83%) patients doesn't required any CPAP.

Table 1: Pattern of use of BCPAP in newborns with respiratory distress

Characteristics	No. of cases	Percentage
Total admissions(in 2 yrs) with no distress	590	37.56
No of babies with distress not requiring CPAP	233	14.83
No of babies on BCPAP	748	47.61
Total	**1571**	**100.00**

Table 2: Maternaland Foetal Risk factors and Outcome with BCPAP

Risk Factors		Outcome		Total (N=748)
		Success (504)	Failure(244)	
Maternal risk factors				
Ante-partum Hemorrhage		10(34.48%)	19(65.51%)	29
Age<21years		71(53.38%)	62(46.61%)	133
Multiple Gestation		40(67.77%)	19(32.20%)	59
Prior Preterm birth		82(60.74%)	53(39.25%)	135
Premature Rupture Of Membrane		20(66.66%)	10(33.33%)	30
Pregnancy Induced Hypertension		67(64.21%)	28(29.47%)	95
Not significant		214(80.14%)	53(19.85%)	267
Foetal Risk Factors				
Gender	Female	228 (77.03%)	68 (22.97%)	296
	Male	276 (61.06%)	176 (38.94%)	452
Gestational Age (wks)	<28	0(0%)	7(100%)	7
	28-30	11(28.9%)	27(71.05%)	38
	30-32	90(62.93%)	53(37.06%)	143
	32-34	133(71.12%)	54(28.87%)	187
	34-36	118(73.29%)	43(26.70%)	161
	36-38	73(75.25%)	24(24.74%)	97
	38-40	47(62.66%)	28(37.33%)	75
	>40	32(80%)	8(20%)	40
Birth Weight (grams)	<1000	08 (23.52%)	26 (76.48%)	34
	1000-1500	107 (61.14%)	68 (38.86%)	175
	1500-2000	152 (68.18%)	71 (31.82%)	223
	2000-2500	136 (79.06%)	36 (20.94%)	172
	>2500	101 (70.13%)	43 (29.87%)	144

Above Table 2 shows outcome of BCPAP with respect to maternal and foetal risk factors. Significant maternal risk factors were found in 481 babies with history of prior preterm delivery was most common followed by age of mother less than 21 years being second. Other risk factors include antepartum hemorrhage, twin gestation, premature rupture of membrane, pregnancy induced hypertension. Highest success rate were seen with babies having no significant antenatal history and lowest success rate seen with babies born to antepartum hemorrhage mothers. (Chi Square test = 49.08; $p<0.001$; Highly Significant) Among the foetal risk factors, table No.02 shows outcome of BCPAP with respect to gender. There were 452 males included in the study out of which 276 were successfully managed while, out of 296 females, 228 were managed successfully. Poor outcome is seen with male patients and this difference was found to be statistically significant.(Chi Square test = 1.72; $p<0.05$;

Highly Significant) Table no. 2 also shows outcome of BCPAP in relation to the gestational age. This table shows that, there is increase in chance of success of outcome of BCPAP as the gestational age increases. Lower gestational age is having lowest success rate.(Chi Square test = 46.16; p<0.001; Highly Significant). Outcome of BCPAP with respect to birth weight of newborn is an important aspect. Highest number of babies were in 1500- 2000gms. Success rate was increased as the birth weight increased. Lowest success rate were seen with birth weight less than 1000 gms. (Chi Square test = 43.87; p<0.001; Highly Signficant).

DISCUSSION

Table 1 shows that, during the study period of two years 1571 babies were admitted in the inborn section of NICU, out of which, 981 (62.44%) babies were having some degree of respiratory distress, out of which 748 (47.61%) were kept on bubble BCPAP and were included in the study. 233 (14.83%) babies with severe respiratory distress needed intubation at time of admission and were not included in study. Comparing with other studies we get study by Zaazou MH *et al*[4] mentions 19% babies needed BCPAP. Other study by Mathur NB[5] in his study mentioned 29.2% babies requiring BCPAP. Were as study by Buckmaster*et al*[6] in his study mentioned 50% incidence of respiratory distress requiring BCPAP. Table No 02 shows outcome of BCPAP with respect to maternal and foetal risk factors. Among various maternal risk factors noted majority were age less than 21 years and previous history of preterm. There were 267 babies which did not have any known maternal risk factors. Out of these 267 normal babies 214 were successfully treated with BCPAP and 53 failed in their treatment. There were 481 babies having maternal risk factors 191 babies failed on BCPAP. This difference is found to be statistically significant. Ante-partum haemorrhage is associated with high failure rates. In our study 29 babies with APH, out of which 19 failed the BCPAP. This difference was statistically significant. Study by Vora HD *et al*[7] also shows the high failure rates in babies born to APH mothers and is statistically significant. In contrast study by Mahadevi N *et al*[8] has 4 patients in each study and control group of APH and did not find significant difference in outcome the difference is due to very small sample size. The difference could be due to very low gestational age of babies born to APH mothers in our study. Another study by Sharba SAZ *et al*[9] finds multiple gestations to be significant in failure of BCPAP. This is due to multiple gestation is strongly associated with lower gestational age leading greater severity of hyaline membrane disease. With regard to PIH, Our study matches with study by Vora HD *et al* [7] which shows out of 10 PIH babies only 3 failed and was found statistically significant. A study by Mazela J *et al*[10] mentioned PIH as significant factor of BCPAP failure. Among foetal risk factors, in our study poor outcome was seen in males. Failure rate in male and female were 38.93% and 22.97% respectively, this difference is statistically significant. Study by Vora HD *et al*[7] shows higher mortality in males 41.3% vs female 36% but difference was insignificant. A study Rocha *et al*[11] also showed increased failure rates in males. The outcome of BCPAP with respect to gestational age and birth weight studied in the present study. Failure rates decreases as the gestational age and birth weight increases with high failure rates in lower gestational ages and birth weights while, failure decreases as the gestational age and birth weight increases. Dargaville *et al*[12] shows similar result with greater failure rates in lower gestational age. Urs PS *et al*[13] mentioned gestational age as predictor of failure of BCPAP with lower failure rates with advanced gestational age. In multicentric randomized control trial Bober k *et al*[14] also concluded lower gestational age major risk factor of failure of BCPAP.

SUMMARY AND CONCLUSIONS

Out of 748 babies kept on BCPAP, 504 (67.37%) were successfully treated and 244 (32.63%) failed and required intubation. Most of the preterm babies were having mothers age less than 21 yrs. Maternal risk factors like antepartum hemorrahge, multiple gestation, prior preterm birth, premature rupture of membrane were associated were poor outcome while, pregnancy induced hypertension has better outcome as compared to other antenatal risk factors. With regard to foetal risk factors, compared to female gender poor outcome was seen in males. The outcome of BCPAP with respect to gestational age and birth weight shows that failure rates decreases as the gestational age and birth weight increases with high failure rates in lower gestational ages and birth weights. BCPAP is very effective in managing newborns with respiratory distress in poor resource setups where patients are not affordable to take sophisticated treatments like surfactant due lack of expertise or lack of facility. Currently, the use of CPAP is increasing due to the advantage of being less expensive, less damaging and having reduced incidence of the chronic lung disease and broncho-pulmonary dysplasia over the use of invasive mechanical ventilation. Indigenous BCPAP is now-a-days considered as a first line therapy for management of respiratory distress in newborn.

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