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Original Research Article

Outcome Of Indigenous Cpap In Newborns With Respiratory Distress

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Abstract

Background & Methods: The aim of the study is to study the Outcome of Indigenous cpap in newborns with Respiratory Distress. This study was carried out using indigenously designed nasal CPAP circuit. It consists of three major components, a continuous oxygen flow into the circuit, an expiratory limb to create positive end expiratory pressure which is immersed into water and the nasal prong which connect neonatal airway to circuit.

Results: Among the neonates with respiratory distress who needed CPAP support 51(17%) had RDS, 96(32%) had Pneumonia and 39(13%) had PPHN. Outcome of CPAP of the study patients, it was observed that out of 108 patient more than three fourth (78.7%) patients were found successfully weaned and 23(21.3%) were failed.

Conclusion: It is concluded from this study that CPAP is an effective way of management of neonates with respiratory distress due to various causes. Mortality was highest in patients who didn't improve on CPAP.

Keywords: Indigenous, cpap, newborns, Respiratory & Distress.
Study Design: Observational Study.

1. Introduction

Respiratory distress occurs in 0.96-12% of life birth and is responsible for about 20% of neonatal mortality.1 It is the most common presenting problem of newborn encountered within the first 48-72 hours of life and remains the primary indication for admission to neonatal intensive care unit to combat respiratory failure[1].

Continuous Positive Airway Pressure (CPAP) is a well-established mode of respiratory support in newborns. Advancement in technology, increasing survival of extremely preterm newborns and better understanding of various respiratory diseases led to new evidence in this field over last decade[2]. Other than RDS, during post-extubation, apnea of prematurity CPAP may be useful in conditions that result in alveolar collapse or airway narrowing. It relieves the signs of cardiac failure due to patent ductus arteriosus. Similarly, it is often used

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in the management of pneumonia, transient tachypnea of newborn, postoperative respiratory management, pulmonary edema and pulmonary hemorrhage. In meconium aspiration syndromes (MAS), application of CPAP can be beneficial by resolving the atelectatic alveoli due to alveolar injury and secondary surfactant deficiency[3].

It can be applied via a face mask, nasopharyngeal tube, or nasal prongs, using a conventional ventilator, bubble circuit or a CPAP driver. Bubble CPAP is one of the lowcost nasal CPAP delivering systems, with underwater seal. CPAP delivered by underwater seal causes vibration of the chest due to gas flow under water; and these vibrations simulate waveforms produced by high frequency ventilation[4]. Gregory et al5 first pioneered the use of CPAP in Neonatology with their landmark paper in the 70s. CPAP differs from conventional CPAP in that in CPAP the expiratory limb is placed under water and oscillatory vibrations are transmitted into the chest resulting in waveforms similar to those produced by high-frequency ventilation[5].

Conventionally neonates with respiratory distress are managed by respiratory support with positive pressure ventilation (delivered usually by mechanical ventilator) and surfactant replacement therapy. In the developed world mechanical ventilator and CPAP machines are the mainstays of respiratory support in neonates but these machines are too expensive and many resources constrained in low socioeconomic countries. The effectiveness of locally adapted CPAP has been documented. CPAP is a simple and cost effective respiratory support system (RSS) which consists of products that are easily available and health care provider can easily be trained to make and use this RSS. CPAP is as effective as the other forms of CPAP, and can reduce the CPAP failure rate and the length of hospital stay. CPAP prevents the alveolar collapse and ensures gas exchange throughout the respiratory cycle and allows the lung inflation to be maintained. It can be effectively given through the nasal prongs which eliminate the need for the endotracheal intubation[6].

2. Material and Methods

This study was carried out using indigenously designed nasal CPAP circuit. It consists of three major components, a continuous oxygen flow into the circuit, an expiratory limb to create positive end expiratory pressure which is immersed into water and the nasal prong which connect neonatal airway to circuit.

The length of tubing immersed underwater determines the required pressure and can be adjusted. With this technique gas flows past the nasal device and pressure is generated in the circuit by placing the distal limb of CPAP circuit under a known depth of water. This produces bubbling, which is known to produce pressure oscillations of up to 4cm of H2O measured in circuit that contributes to gas exchange.

All pretrem babies delivered at or less than 32 weeks of gestation in a tertiary care centre in central India were started on prophylactic CPAP soon after birth, irrespective of presence or absence of signs of respiratory distress.

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All neonates born with meconium stained liquor, having signs of respiratory distress i.e Respiratory rate>60/ min, nasal flaring, sub coastal retractions, inter coastal retractions, grunting were started on CPAP and were monitored using Downes score.
All neonates presented with signs of respiratory distress within 72 hours of birth were started on CPAP.
Newborns with congenital anomalies were excluded from the study.
Neonates on CPAP were assessed for adequacy and complications of CPAP. Following parameters were monitored-
Vitals- Heart rate, temperature, respiratory rate, BP, SPO2.
Assessment of circulation- CRT, BP, Urine output.
Scoring of respiratory distress- using Silverman score or Downes score.
Neurological – Tone, activity, responsiveness
Chest x- ray
Blood gas- PaO2, PCO2,pH.
Inability to maintain SpO2 >90% or PaO2>50mmHg with FiO2 > 60% and pressure >7cm of water and PaCO2>60mm of Hg on CPAP is considered as CPAP failure.
Neonates who met criteria of CPAP failure were further put on mechanical ventilation. Surfactant administration was done in neonates showing features of RDS using INSURE technique.

Inclusion criteria

- Newborns born at or before 32 weeks of gestational age.
- Newborns after 32 weeks of gestational age with respiratory distress.
- Newborns born after 32 weeks of gestational age with meconium stained liquor (MSL).

Exclusion criteria

- Newborns with congenital anomalies.
- Newborns needed intubation at birth.
- Out born babies were excluded from the study.

3. Result

Table 1: Distribution of the study patients by age, sex, birth weight, gestational age and mode of delivery

S. No.	Birth Weight	Number	Percentage
1	1-1.5 kg	142	47.3
2	1.5-2 kg	67	22.3
3	2-3 kg	60	20
4	More than 3 kg	31	10.3
S. No.	**Gestational Age (wk)**	**Number**	**Percentage**
1	28-32	48	16

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2	33-36	75	25
3	37-41	177	59
S. No.	**Mode of delivery**	**Number**	**Percentage**
1	NVD	126	42
2	LSCS	174	58

Table No. 2: Distribution of the study patients according to Diagnosis

S. No.	Diagnosis	Number	Percentage	P Value
1	**RDS**	51	17	.006422
2	**Pneumonia**	96	32	
3	**PPHN**	39	13	
4	**MAS**	24	08	
5	**TTN**	15	05	
6	**Cong. Pneumonia**	36	12	
7	**Sepsis**	27	09	
8	**Laryngomalacia**	12	04	

Among the neonates with respiratory distress who needed CPAP support 51(17%) had RDS, 96(32%) had Pneumonia and 39(13%) had PPHN. The chi-square statistic is 12.3002. The *p*-value is .006422. The result is significant at $p < .05$.

Table No. 3: Distribution of cases of RDS survivors in relation to the initiation of CPAP (in hrs).

S. No.	Initiation of CPAP (hrs.)	Number	Percentage	P Value
1	**01**	45	15	< 0.00001
2	**02**	63	21	
3	**03**	108	36	
4	**04**	33	11	
5	**05**	42	14	
6	**06**	09	03	

The mean time of starting CPAP among survivors of RDS was 3 hrs(range 1-6 hrs).
The mean time of starting CPAP among deaths in RDS was 2.5 hrs (range 1-5 hrs).
The mean duration of CPAP among survivors was 39.6 hrs (range 12-96 hrs)
The chi-square statistic is 40.9303. The *p*-value is < 0.00001. The result is significant at $p < .05$.

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Table No. 4: Distribution of the study patients according to outcome of CPAP

S. No.	Outcome of CPAP	Number	Percentage
1	**Wean**	231	**77**
2	**Failure**	69	**23**

Outcome of CPAP of the study patients, it was observed that out of 108 patient more than three fourth (78.7%) patients were found successfully weaned and 23(21.3%) were failed.

4. Discussion

Since the first successful reporting of use of CPAP in treating RDS by Gregory et al., [6] many studies have been published evaluating the effectiveness of CPAP. Many approaches with different combinations of all the available modalities, including CPAP, surfactant and MV have been assessed for their efficacy. These approaches included Prophylactic surfactant followed by a period of MV, prophylactic surfactant followed by bubble nasal CPAP or initial management with bubble CPAP and selective surfactant treatment. Out of all these strategies, The Scandinavian model, the so-called INSURE procedure, has been in use for almost two decades.

The current study reported the short term outcome of the early CPAP therapy with selective administration of surfactant in 70 premature newborn with <32 weeks of gestation. Majority of the cases received bubble CPAP. The incidence of CPAP failure was 30% (95% CI 19.3% to 40.7%) in study population. The proportion of neonates who required surfactant was 18.6% (9.5% to 27.7%), who developed ROP was 37.1% (25.8% to 48.5%) and the proportion of babies, who met with mortality was 7.1% (1.1% to 13.2%) Nasal Trauma, Hypotension, Intra Ventricular Hemorrhage and CPAP belly were the most common complications, occurring in 80% (70.6% to 89.4%), 11.4% (4% to 18.9%) and 10% (3% to 17%) of neonates each respectively. The other complications observed were CPAP belly, oliguria, septal injury, metabolic acidosis etc. No case of pulmonary hemorrhage was reported in the study.

One of the very early preliminary report on Use of the 'Gregory box' (CPAP) in treatment of RDS of the newborn have reported lesser mortality with CPAP compared to existing methods. Bassiouny et al., [7] in their study of Forty-four premature infants with RDS, treated with binasal, have reported the incidence of CPAP failure as 39% and significant improvement of RDS with a mild to moderate degree of severity on CPAP. They have also reported significantly lower incidence of infection, apnea, intraventricular hemorrhage and retinopathy of prematurity with CPAP. No pneumothorax was reported in the study.

Sai Sunil Kishore et al., [9] in their stratified open-label randomized controlled trial, neonates (28-34 weeks gestation) with respiratory distress within six hours of birth were randomly allocated to 'early-NIPPV' or 'early-CPAP' after stratifying for gestation (28-30 weeks, 31-34 weeks) and surfactant use. Failure rate was less with 'early-NIPPV' versus 'early-CPAP' [13.5% vs. 35.9%, respectively, RR 0.38 (95% CI 0.15-0.89), p = 0.024]. Similarly, need for intubation and MV by seven days (18.9% vs. 41%, p-0.036) was less with NIPPV. The

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authors concluded early use of NIPPV reduces the need for intubation and MV compared to CPAP[10].

5. Conclusion

It is concluded from this study that CPAP is an effective way of management of neonates with respiratory distress due to various causes. Mortality was highest in patients who didn't improve on CPAP.

6. References

1. Chan KM, Chan HB. Te use of Bubble CPAP in preterm infants: Local experience. HK J Paediatr 2007;12:86-92.
2. Wang TF, Dang D, Liu JZ, Du JF, Wu H. Bubble CPAP for Preterm Infants with Respiratory Distress: A Meta-analysis. HK J Paediatr 2016;21:86-92.
3. Koti J, Murki S, Gaddam P, Reddy A, Reddy MDR. Bubble CPAP for respiratory distress syndrome in preterm infants. Indian Peditr 2010;47:139-43.
4. Courtney SE, Pyon KH, Saslow JG, Arnold GK, Pandit PB, Habib RH. Lung recruitment and breathing pattern during variable versus continuous flow nasal continuous positive airway pressure in preterm infants: an evaluation of three devices. Pediatr 2001;107:304-08.
5. Koyamaibole L, Kado J, Qovu JD, Colquhoun S, Duke T. An evaluation of bubble-CPAP in a neonatal unit in a developing country: Effective respiratory support that can be applied by nurses. J Trop Pediatr 2006;52:249-53.
6. Gregory GA, Kitterman JA, Phibbs RH, Tooley WH, Hamilton WK. Treatment of the idiopathic respiratory-distress syndrome with continuous positive airway pressure. The New England journal of medicine. 1971;284(24):1333-40.
7. Dunn PM, Thearle MJ, Parsons AC, Watts JL. Use of the 'Gregory box' (CPAP) in treatment of RDS of the newborn: preliminary report. Archives of disease in childhood. 1972;47(254):674-75.
8. Bassiouny MR, Gupta A, el Bualy M. Nasal continuous positive airway pressure in the treatment of respiratory distress syndrome: an experience from a developing country. Journal of tropical pediatrics. 1994;40(6):341-44.
9. Sai Sunil Kishore M, Dutta S, Kumar P. Early nasal intermittent positive pressure ventilation versus continuous positive airway pressure for respiratory distress syndrome. Acta paediatrica (Oslo, Norway : 1992). 2009;98(9):1412-15.
10. Finer NN, Carlo WA, Walsh MC, Rich W, Gantz MG, Laptook AR, et al. Early CPAP versus surfactant in extremely preterm infants. The New England journal of medicine. 2010;362(21):1970-79.