

Use of Nasal Continuous Positive Airway Pressure as a Mode of Respiratory Support in Newborns at SAT Hospital, Trivandrum

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ABSTRACT

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Background: Respiratory distress is one of the leading causes of mortality in a newborn ICU. Though endotracheal intubation and mechanical ventilation is the gold standard in the management of acute respiratory failure, it is not without complications. The Continuous positive airway pressure (CPAP) is used as an alternative for maintaining an increased trans-pulmonary pressure during expiratory phase of respiration in a spontaneously breathing infant. However CPAP is considered as effective as to mechanical ventilation and has fewer complications, its usefulness in a tertiary care ICU in resource poor settings is yet to be studied.

Objective: To study the use of Nasal CPAP in managing respiratory distress in a tertiary care pediatric ICU.

Methods: this descriptive study was performed in the 75 consecutive newborn babies with respiratory distress admitted in inborn nursery of SAT Hospital, Trivandrum. The Outcome measures are the efficacy of nasal CPAP as measured by improvement in Downe score as assessed at intervals after intervention.

Results: A total of 75 infants were treated with nasal CPAP; of these, 55 infants (73.3%) improved with CPAP alone, 44 cases had Hyaline membrane disease out of these 63.63% improved with nasal CPAP, 13 (17.3%) died and 7 (9.3%) required ventilation. All cases with meconium aspiration improved with nasal CPAP. There were no major complications like pneumothorax.

Conclusions: Nasal CPAP seems to be a safe alternative to routine intubation and mechanical ventilation in managing respiratory distress cases in resource limited settings.

Keywords: Respiratory distress, Nasal continuous positive airway pressure (CPAP), Respiratory Support, Endotracheal intubation, mechanical ventilation

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INTRODUCTION AND BACKGROUND

Respiratory distress is one of the leading causes of mortality in a newborn ICU. The most common causes of respiratory distress are Hyaline membrane disease, Transient Tachypnoea of newborn, meconium aspiration syndrome, congenital pneumonia, primary pulmonary hypertension and anatomical anomalies like congenital diaphragmatic hernia. Respiratory distress in newborn is usually presented with tachypnoea, inspiratory retractions and expiratory grunting. In most tertiary care centers respiratory distress in newborns will be managed preferentially with mechanical ventilators. Though endotracheal intubation and mechanical ventilation is the gold standard in the management of acute respiratory failure, it is not without complications. The complications range from acute pharyngeal and laryngeal injury vagal stimulation apnoea and

bradycardia, laryngeal oedema, pneumothorax, atelectasis, introduction of nosocomial infection to late complications like structure and subglottic stenosis hence non invariable ventilation is gain among more acceptances recently.

The Nasal continuous positive airway pressure (CPAP) is used as an alternative for maintaining an increased trans-pulmonary pressure during expiratory phase of respiration in a spontaneously breathing infant. Continuous positive airway pressure is a continuously applied distending pressure used for maintenance of an increased trans-pulmonary pressure during expiratory phase of respiration in a spontaneously breathing infant. It is distinct from intermittent positive pressure ventilation or intermittent mandatory ventilation in which breathing is taken over by machine completely and the increase in pulmonary pressure occur during

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both inspiratory as well as expiratory phase.

The major cause of mortality due to respiratory distress in our hospital is our inability to provide ventilatory support to babies with respiratory distress, so early use of Nasal CPAP will be a low cost, simple and non invasive option for us.

Though Nasal CPAP is as effective as mechanical ventilation and has fewer complications, the usefulness of Nasal CPAP in a tertiary care ICU in resource limited settings is yet to be studied.

Positive pressure therapy was first used by Poulton and Oxan (1936) who used face mask to treat acute ventilatory insufficiency. Harrison is credited to first recognize the benefit of an increased alveolar pressure during expiration in infants with respiratory distress syndrome. He observed that granule appears in cases of RDS which increase progressively with increasing severity of disease and abolition of this granule by use of endotracheal tube led to decrease in partial pressure of oxygen and further worsening of the disease. In 1971, Gregory et al used CPAP for the first time in spontaneously breathing neonates with idiopathic RDS. Over the last 3 decades severe methods of applying CPAP have become routinely available. In recent years newer such as Bubble CPAP and Dual flow system (Infant flow drive)

Physiological consideration

The main application of CPCA is in treatment of hypoxemia. It does this by complex but integrated mechanisms. In doing so it has some desirable and some undesirable effects on other body systems as well.

Respiratory system

CPAP causes increase in thoracic lung volume and functional residual capacity (FRC), decrease in airway resistance decrease in lung compliance improvement in respiratory rate tidal volume and minute volume, regularization of respiration improvement in surfactant metabolism splinting of chest wall airways and the pharynx pneumatic splinting and reduced work of breathing.

Improvement in oxygenation occurs because of reopening of collapsed and/or unstable alveoli. This increase alveolar surface areas for gas exchange decreases intrapulmonary shunting and improves surfactant metabolism. Reduction in compliance occurs which suggest that over distension of normal air spaces is more prominent than recruitment of collapsed alveoli.¹ The beneficial effect of CPAP is

due to prevention of progressive alveolar collapse with marginal stability of alveoli. By preventing collapse of alveoli CPCA also conserves surf factors. This is why CPAP is more effective early in disease when most alveoli are still open II.

In extremely low birth weight babies the chest wall is very compliant and tends to collapse with descent of diaphragm Paradoxical respiration. This results in small and ineffective tidal volumes. CPAP helps by splinting the chest wall and the airways which increase caliber. This decreases airway resistance and improves the ventilation of lung segments supplied by airways. Thus permitting a larger tidal volume for a given pressure. Thus reducing the work of breathing. The work of breathing is further reduced by constant flow of gas directed to the patient does part of the work.

Cardiovascular effects

CPAP increase in intrathoracic pressure which can decrease venous return ultimately leading to decrease venous return ultimately leading to decrease in cardiac output.² This results in poor perfusion as oxygen availability to tissue decrease.³ This change in cardiac output results in decline in arterial blood pressure. These effects are enhanced in hypovolemic patients. These cardiovascular effects occur only at supra optimal CAAP pressure giving optimal CPAP should improve metabolic acidosis and cardiac output.

Renal system

CPAP can result in decrease in glomerular filtration rate and thus the urine output.⁴ Renal effects are directly proportion to compliance of the chest wall.

Gastro intestinal tract

Abdominal distension can occur in babies on CPAP.⁵ It is compounded by presence of immature gut in preterm and some decrease in blood flow to the gut. All these together leads to what is called as CPAP belly syndrome. Clinically baby develops increased abdominal girth and dilated lower loop which may cause upward pressures on diaphragm and respiratory compromise.

Central nervous system

There is increase in intracranial pressure with application of CPAP. This in combination with decrease in arterial pressure, results in decrease in cerebral perfusion pressure CPAP. Increases in ICP is instrumental in pathogenesis of intraventricular hemorrhage in low birth weight babies ventilated for RDS. Increase in ICP is seen more with head box CPAP than with modes

of Delivery of CPAP. Endotracheal CPAP or nasal prongs.^{6,7}

Gregory et al first described two methods of delivery of CPAP in 1971 for treatment of RDS through endotracheal tube and by pressure chamber around infants head.⁸ Subsequently face mask and nasopharyngeal tube have been used⁹ currently the most commonly used method is delivery of CPAP by nasal prongs.¹⁰ These are useful and effective as neonates are obligate nasal breathers. The prongs can be sterilized and reused making them very cost effective. Mouth leak provides pressure drop; there is no benefit of forcible mouth closure as the transient benefit is outweighed by occurrence of gastric distension and rupture. Prongs can cause trauma to nasal turbinate and septum. They are not universally beneficial in infants less than 1000 to 1250 grams. Single prong nasal CPAP has been used by cutting short an endotracheal tube. It can be used to deliver both nasal and nasopharyngeal CPAP. However, double nasal prongs have been shown to be better than single nasal prongs for CPAP delivery¹¹ what should be the optimal length of nasal prongs has yet not been reached thoroughly.

Endotracheal CPAP should preferably be used due to its invasiveness and resistance and baby can be cured. Cochrane review¹² prohibits the uses of ETCAPAP even before extubation as it offers no help and decreases the chance of successful extubation.

Newer CPAP systems

Bubbles CPAP is delivered by CPAP system with under water seal. It has been shown that CPAP delivered by under water seal causes vibration of the chest due to gas flow under water which is transmitted to infants' airway. These vibrations stimulate waves in forms produced by high frequency ventilation.¹³ Bubbles CPAP has also been shown to reduce need for intubation and mechanical ventilation.¹⁴ Postnatal steroids and trend towards decreased incidence of chronic lung disease.¹⁵

IFD

Another new mode of CPAP delivery is the use of dual flow CPAP or infant flow drive CPAP. In contrast to other bubble systems it uses fluid flip mechanism which is claimed to provide a more stable CPAP throughout the respiratory cycle both inspiration and expiration so that there is less variation in airway pressure.¹⁶

Mazella et al have shown superiority of IFD over bubble CPAP in terms of decreased oxygen requirements and respiratory rates and less or need for mechanical

ventilation.¹⁷ Babies who failed nasal CPAP could be rescued by IFD and mechanical ventilation can be avoided.

Conventional ventilators for CPAP

When a ventilator generates CPAP pressure the flow is set, often between 2 and 6 L/min. There is no easy way of knowing whether this flow is sufficient for baby inspiratory needs. If the flow is too low the work of breathing may be increased. The work of breathing was found to be increased with conventional ventilator driven (CPAP circuit flow limited to 62/ml) compared with an IFD system maintenance pressure at the device level with variable flow. A flow of 62/ml is certainly sufficient to supply the minute volume of all but the largest, most vigorously breathing infants, but it is not minute volume that determines the flow required in nasal CPAP. The leak that is the continuous flow of gas through the nose and out through the mouth affects how much flow is required to maintain the CPAP. Pressure in the pharynx. The leak may be several liters per minute. Then flow through the device needs to be higher to provide enough flow to maintain the pharyngeal pressure. In theory too much flow might be better than too low a flow.

Benveniste device

As with IFD, altering the flow to the Benveniste device directly alters the pressure at the level of the attached nasal prongs. The Benveniste device requires high gas flow with up to 142/ml to generate pharyngeal pressure of between 3 and 10.5 cm of water.

Optimal Pressure

The purpose of nasal CPAP is to deliver a supporting pressure to the upper airways and lungs. If this is achieved consistently it may not matter which device is used. A pressure of 5 cm water is traditionally used. Some neonatal intensive care units hardly vary this and claim good results. A recent report studying 60 infants with mild RDS, showed the highest and expiratory lung volume and tidal volume and the lowest respiratory rate and thoraco abdominal asynchrony, at a pressure of 5 and compared with 0, 2, 4 and being of water.

The optimal CPAP pressure is not known and may depend on the condition treated. A baby with RDS, relatively stiff lungs, a high FIO₂ and a chest X-ray showing rather opaque lungs may need a higher pressure to support lung volume than a baby with a low FIO₂ treated for apnoeic episodes. Studies in the

1990s have applied CPAP pressures as high as 10 cm of water.

However caution must be exercised as the inappropriate use of high pressure in an infant with compliant lungs may restrict pulmonary blood flow, increase the risk of air leak or cause over distension. If an infant shows evidence of worsening of lung disease with increasing oxygen requirements and a more opaque chest then pressure increments of 1 cm of water up to 10 cm of water.

Indications of CPAP

1. Abnormalities on physical examination – the presence of increased work of breathing as indicated by a 30 – 40% increase above normal in respiratory rate, substernal and suprasternal retractions, grunting and nasal flaring, the presence of pale or cyanotic skin color and agitation.
2. Inadequate arterial between gas values the inability to maintain PaO₂ greater than 50mm Hg with FIO₂ of ≤ 0.4 provided ventilation is adequate as indicated by a PaCO₂ level of 55 mm Hg and a PH $> \text{or} = 7.25$.
3. The presence of poorly expanded and infiltrated lung field on chest X Ray
4. Presence of a condition through to be responsive to CPAP such as
 - Respiratory distress syndrome
 - Pulmonary edema
 - Atelectasis
 - Meconium aspiration syndrome
 - Apnoea of prematurity
 - BPD
 - Bronchiolitis
 - Recent extubation
 - Tracheomalacia
 - Transient tachypnoea of newborn

Failure of CPAP

CPAP failure is defined as PaCO₂ less than 50mm Hg at pressure of sum of H₂O at a FiO₂ of 0.8.

CPAP failure can occur due to

- Recurrent apnoea
- Increased work of breathing due to worsening of the disease

- Intracranial haemorrhage
- Progressive metabolic acidosis
- Pulmonary oedema
- Lack of nutrition with respiratory muscle fatigue.

Remediable causes of CPAP failure which should be looked in to are

- Improper fixation of CPAP device
- Frequent dislodgement
- Excessive secretion obstructing the airway or nasal prongs
- Low flow rates in the circuit
- Faulty machine delivering lower pressure of FIO₂ than displayed on the screen.

CPAP failure is more likely to occur in extremely low birth weight babies (<1000g) and in babies with severe HMD or pneumonia. A delay in initiating CPAP is more likely to be associated with failure.

Contraindications

1. Upper airway abnormalities that makes NCPAP or NP-CPAP ineffective or potentially dangerous (eg: choanal atresia, cleft palate, tracheoesophageal fistula)
2. Severe cardiovascular instability and impending arrest
3. Unstable respiratory drive with frequent apnoic episodes resulting in desaturation and / or bradycardia.
4. Ventilatory failure as indicated by the inability to maintain PaCO₂ < 55 mHg and PH > 7.25 .
5. Application of NCPAP to patients with untreated congenital diaphragmatic hernia.

Complications

1. Pulmonary air leaks (PAL) are probably the most important clinically significant adverse effect. The incidence of pneumothorax during nasal CPAP increases with increasing gestation age. PAL tends to occur when oxygen requirements are decreasing and lung compliance is improving.
2. Use of excessive PEEP may compromise oxygenation. Excessive increase in PEEP may increase the blood flow to unventilated region, which causes ventilation and perfusion mismatch this leads to decrease in oxygenation.

3. Abdominal distension and gastric rupture are well documented complications of CPAP (CPAP belly syndrome). This can be minimized by routine use of orogastric tube. The use of nasogastric tubes should be avoided because most neonates are preferential nasal urethers and occlusion of one nostril decreases air entry and increases the work of breathing moreover with nasal CPAP, fixation and seal become a problem with nasogastric tube
4. Cardiac output is believed to decrease due to decrease in venous return because CPAP causes increase in intrathoracic pressures, decreased right ventricular stroke volume and altered dispensability of left ventricle. The effects can be minimized by optimal CPAP and achieving adequate intravascular volume.
5. Local complications like nasal septal erosion, necrosis or nasal mucosal damage due to inadequate humidification.

OBJECTIVE

To study the use of Nasal CPAP in managing respiratory distress in a tertiary care pediatric ICU

METHODS

Study was designed as a hospital based descriptive study. The Inborn nursery at SAT Hospital, Medical College, Trivandrum was the study setting. All neonates admitted to the new born nursery with respiratory distress having Downe's score more than 4 have been included and those with Major congenital anomalies like congenial diaphragmatic hernia and Upper airway abnormalities like choanal atresia, cleft palate, trachea esophageal fistula which prevent effective delivery of CPAP have been excluded. Samples are the 75 consecutive babies admitted in inborn nursery during the Study period January 2005 – June 2005

Outcome measures

Efficacy of nasal CPAP as measured by improvement in Downe score as assessed at 1 hr, 12 hrs, 24 hrs and 48 hrs after intervention. Frequency of adverse outcome during the period of administration of CPAP

Steps used for the Study in our Newborn Nursery

1. Any new born with respiratory distress in the nursery the gestation was assessed along with the present status and the possible cause. Babies were excluded from the study on the basis of exclusion

criteria as mentioned in the protocol.

2. Infants were nursed in a resuscitate with overhead radiant warmer. Initial assessment included a SpO₂ measurement, associated with clinical assessment of the degree of reparatory distress were first treated with humidified oxygen by hood at a rate 4-6 litres/minute. Other supportive measures like administration of parental fluids and correction of associated metabolic problems were simultaneously done.
3. A blood gas analysis and random blood sugar analysis was to be done if possible. Respiratory distress was diagnosed if any of the two were present (i) Respiratory rate > 60/min during quiet breathing (ii) Inspiratory retractions of chest (iii) Expiratory grunting. Then the baby was started on CPAP when Downes score was above 4.
4. Prior to initiating CPAP a chest X ray was taken depending on the degree of distress and safety of transportability of the child. An estimation of haemoglobin was also done. Both the above investigations were done within two hours of admission in the new born ICU. A provisional diagnosis was assigned to each baby.
5. The babies (especially if the babies were bigger) were sedated as they are often uncomfortable with prongs in the nose and an irritable child will not allow optimum function of the CPAP
6. The clinical condition of the babies on whom intervention is decided was then discussed with the parents and the outcome was explained with and without the procedure. The possible problems that could arise as a result of CPAP, along with the need for ventilation if the baby did not respond were explained. Following the signing of the written consent the procedures of setting up CPAP was initiated.
7. The apparatus used in this study was
 - i. Under water seal used in drainage of an inter coastal tube usually; of the SAFEX brand
 - ii. Pediatric nasal prong.
 - iii. T tube which was used to connect the three limbs
 - iv. The central oxygen supply of the hospital
 - v. Cannula to carry the oxygen from the central supply to the circuit, it was connected to the T tube.
 - vi. Sterile water to form the water level in the under water seal.
8. The apparatus was connected as shown in the

- circuit. Prior to connection of the circuit to the body bubbling was confirmed. The pressure usually started on is 6 cm of water.
9. Suctioning of the airway prior to application of CPAP prongs was done. Orogastric tube was inserted and stomach contents were aspirated was then left in place. If these procedures are done prior to prong placement then less handling is required after infant is on CPAP.
 10. Place a roll under the infant's neck to slightly extend the neck. It ensures optimum airway.
 11. Applying the prongs. Gently insert the prongs that fit the nares snugly without causing pressure. Place curve side down into the baby's nose (follow the natural curve of the nose). Nasal prongs should fill the nasal opening completely without stretching the skin or putting undue pressure on the nares (blanching around the rim of the nostrils suggests that the prongs are too large). There should be no lateral pressure on the septum causing it to be pinched or twisted.
 12. Once the prongs were set in place the CPAP was initiated. The bubbling of the water in the under water seal should neither be too vigorous nor vary with respiration, it should be continuous with a minimum force.
 13. Assess the SPO_2 continuously till the new born stabilizes, target values is above⁹². A blood gas analysis should be done after baby stabilizes along with a respiratory distress scoring preferably in the first hour to assess the degree of improvement and do the necessary supportive measures based on these. Downe scoring was done at 12, 24 and 48 hours also.
 14. Optimal posture: Despite the lack of evidence that it is optimal for the baby, the supine position is often used as it facilitates easier care of the CPAP device.
 15. Monitoring of the respiratory rate along with the respiratory effort, the oxygen saturation, and the circulation with the help of heart rate capillary refill time was done at regular intervals. CPAP is only life saving if the proper supportive measures are started.
 16. Failure of nasal CPAP is indicated by worsening clinical scores, persistent serious episodes ($PaCO_2$ of >60 mmHg (8.3kPa), FiO_2 of >0.6 to maintain acceptable oxygen saturation) include treatable causes of apparent CPAP failure include insufficient applied pressure, in sufficient circuit flow, inappropriate prong size or placement, airway obstruction from secretions, and a baby's open mouth creating a large leak and lowering the pharyngeal pressure. Once the treatable causes were looked into and corrected and the child still continued to deteriorate the baby was taken of CPAP and connected to the ventilator when available.
 17. Assessment of outcome: CPAP is initiated at levels of 4-5 cm H₂O and may be gradually increased up to 10 cm H₂O to provide the following:¹⁸
 - i. The presence of clinically acceptable noninvasive monitoring of oxygen.
 - ii. Reduction in the work of breathing as indicated by a decrease in respiratory rate by 30-40% and a decrease in the severity of retractions, grunting and nasal flaring.
 - iii. Improvement in patient comfort as assessed by medical personnel.
 18. Weaning was based on improvement in clinical scores and the improvement and stabilization in SpO_2 for a period of 24 hrs. CPAP was reduced in decrements of 1-2cms of water checking clinical scores with every decrement. Once the level of the CPAP reaches 5cms of water along with almost normal respiratory mechanics the child is taken of CPAP.
 19. The babies following weaning of CPAP is continued on the proper supportive management like parenteral fluids for maintaining the metabolic requirements and the electrolyte balance. The baby was started on antibiotics or ionotropes based on their individual requirements. If the baby was preterm it was monitored for the other possible complications.
 20. On complete recovery and discharge the babies were asked to come for review at one month for ROP. The assessment of ROP was done at the Regional Institute of Ophthalmology, Medical College, Trivandrum.
 21. The main limitations in our study was our inability to regulate the amount of oxygen given to the patient as we used an indigenous CPAP machine and we were unable to provide an air blender in the circuit. The next insufficiency we felt was our inability to do ABG on a regular basis for monitoring the patients. This was due to the lack of facilities to a blood gas analysis in out hospital.

RESULTS

A total of 75 infants were treated with nasal continuous positive airway pressure; of these, 55

infants (73.3%) improved with CPAP alone, 44 cases had Hyaline membrane disease out of these 63.63% improved with nasal CPAP, 13 (17.3%) died and 7 (9.3%) needed ventilation. All cases with meconium aspiration improved with nasal CPAP. All cases with meconium aspiration improved with nasal CPAP included congenital pneumonia, persistence pulmonary hypertension, birth asphyxia, apnoea of prematurity, aspiration pneumonia, transient tachypnoea of new born.

There were no major complications like pneumothorax. The most common problem seen was displacement of the nasal prongs. Other includes nasal excoriation and prong block. Out of 55 babies improved with nasal CPAP. Only one baby had retinopathy of prematurity which was managed by cryotherapy. The outcome of CPAP failure when sniffed to IPPV is poor universally. Out of 7 babies who needed intermittent positive pressure ventilation only two could be saved.

Considering that inexperience apparatus for administration of bubbles CPAP and pulse oximeters which are now available we conclude that CPAP ventilation complemented with pulse oximetry, Respiration distress score and appropriate supportive measures should be adopted even by the smaller hospitals for the management of respiratory distress in the new born period.

DISCUSSION

Respiratory distress is one of the leading causes of mortality among newborn. The major cause of respiratory distress is from hyaline membrane disease and in our hospital we are unable to provide adequate ventilator support and surfactant therapy for all cases due to less number of ventilators and the high cost of surfactant. In this scenario we need an alternate mode of respiratory support for managing the respiratory distress cases.

Of those 75 babies studied, 73.3% improved with CPAP alone 44 cases had Hyaline membrane disease out of these 63.63% improved with nasal CPAP, 25% died and 11.36% with nasal CPAP, 25% died and 11.36% needed ventilation. All cases with meconium aspiration improved with nasal CPAP included congenital pneumonia persistence pulmonary hypertension birth asphyxia apnoea of prematurity aspiration pneumonia transient tachypnoea of new born.

There were no major complications like pneumothorax.

The most common problem seen was displacement of the nasal prongs. Other include nasal excoriation and prong block. Out of 55 babies improved with nasal CPAP. Only one baby had retinopathy of prematurity which was managed by cryotherapy.

The outcome of CPAP failure when sniffed to IPPV is poor universally. Out of 7 babies who needed intermittent positive pressure ventilation only two could be saved. Considering that inexperience apparatus for administration of bubbles CPAP and pulse oximeters which are now available we conclude that CPAP ventilation complemented with pulse oximetry, Respiration distress score and appropriate supportive measures should be adopted even by the smaller hospitals for the management of respiratory distress in the new born period.

75 babies were included in the study (Table 1)

- 73.3% improved with nasal (PAP
- 17.3% died
- 9.3% needed ventilation

No major complications like pneumothorax were seen most common problem seen was displacement of the prongs (Table 2).

Of 55 babies in produced with (PAP only one baby developed ROP in both eyes for which cryotherapy was done (Table 3).

Table 1. Outcome		
Outcome	Frequency	Percentage
Survival	55	73.3%
Deaths	13	17.3%
Ventilated	7	9.3%
Total	75	100%

Table 2. Complications		
Complains	Frequency	Percentage
No complains	37	49.3%
Displaced Pro	28	37.3
Prong block	2	2.7
Nasal excoriation	8	10.6

Table 3. ROP		
ROP	Frequency	Percentage
No ROP	54	72%
ROP (+)	1	1.3%
Ventilated and deaths	20	26.6
Total	75	100

Table 4. Diagnosis and Outcome

Diagnosis	Fre- quency	Per- centage	Survi	Death	Ventil
1. Cong.Pneu	12	16%	11(91.6)	1(8.3)	0
2. HMD	44	58.7%	28(63.63)	11(25)	5(11.36)
3. PPHN	1	1.3%		1(100)	
4. Birth asphyxia	3	4%	2(66.66)	1(33.33)	0
5. Apnoea of pre	2	2.7%	1(100)	0	0
6. Aspn. Pneu	1	1.3%	0	0	1(100)
7. TTNB	5	6.7%	5(100)	0	0
8. MAS	6	8%	6(100)	0	0
9. Weaning	1	1.3%	1(100)	0	0

Table 5. Steroids and Outcome

Steroids	Frequency	Percentage	S	D	Ventilator
Given	24	32	18 (75)	4 (16.6)	2 (8.3)
Not given	51	68	37 (72.54)	9 (17.64)	5 (9.8)

Table 6. Surfactant and Outcome

Surfactant	Frequency (%)	Survival	Death	Vent
Given	11(14.7)	8(72.72)	1(9.09)	2(18.18)
Not given	64(85.3)	47(73.43)	12(18.75)	5(7.81)

Table 7. Gestational Age and Outcome

Gestational age	Frequency	Survived	Deaths	Ventilator
< 30 w	12 (16%)	6 (50)	4 (33.3)	2 (16.6)
≥ 30 w	63 (84%)	49 (77.77)	9 (14.28)	5 (7.9)

Table 8. Surfactant and Outcome

Birth weight	Frequency	Surv	Death	Vent
< 2 kg	47 (62.7%)	31 (65.95)	12 (25.53)	4 (8.5)
≥ 2 kg	28 (37.3%)	24 (85.71)	1 (3.57)	3 (10.7)

Of 75 babies studied 32% received antenatal steroids 75% of them survived, 16.6% died and 8.3% needed ventilation (Table 4).

Of 75 babies studied 32% received antenatal steroids. 75% of them survived, 16.6% died and 8.3% needed ventilation (Table 5).

Of 75 babies included in the study 14.7% were given surfactant out of which 72.2% survived 9.09% died and 18.18% needed ventilation (Table 6).

Survival increased with increase in gestational age (Table 7).

Survival increased with increase in birth weight (Table 8).

CONCLUSION

Nasal CPAP seems to be a safe alternative to routine intubation and mechanical ventilation in managing respiratory distress cases in resource limited settings.

END NOTE

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