A STUDY OF CLINICAL PROFILE AND OUTCOME OF NEONATES VENTILATED WITH BUBBLE CONTINUOUS POSITIVE AIRWAY PRESSURE IN A TERTIARY CARE CENTRE

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MEDICAL COLLEGE,

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ABBREVIATIONS:

ABG	Arterial Blood Gas
AVD	Assisted Vaginal Delivery
bCPAP	Bubble CPAP
BPD	Broncho Pulmonary Dysplasia
CPAP	Continuous Positive Airway Pressure
ET	Endotracheal Tube
Fio2	Fraction of Inspired Oxygen
FRC	Functional Residual Capacity
GA	Gestational Age
LSCS	Lower Section Caesarian Section
MAS	Meconium Aspiration Syndrome
NMR	Neonatal Mortality Rate
NVD	Normal Vaginal Delivery
PaO2	Partial Pressure of Oxygen
PEEP	Positive End Expiratory Pressure
PPHN	Persistent Pulmonary Hypertension
RDS	Respiratory Distress Syndrome
SPO2	Oxygen Saturation
Std	Standard
TTN	Transient Tachypnea of Newborn
vCPAP	Ventilator derived CPAP

ABSTRACT:

Background: Respiratory distress is one of the commonest conditions in preterm neonates requiring NICU admission especially among those less than 34 weeks of gestational age. Timely intervention of this with the usage of CPAP can significantly reduce neonatal mortality and morbidity. **Objectives of the study:** To study the clinical profile and outcome of non invasive ventilation using BUBBLE CONTINUOUS POSITIVE AIRWAY PRESSURE in neonates with respiratory distress in a tertiary care centre.**Methodology:** A prospective study was conducted among the first 200 neonates admitted in NICU with respiratory distress between November 2018 to October 2019.Downes score was used to assess the respiratory distress at the time of admission. **Results:**81.5% of the babies showed improvement with CPAP and were weaned to oxygen hood and 18.5% babies required mechanical ventilation. Earlier application of CPAP showed good outcome. Neonates between 32 to 36 weeks were highly benefitted with usage of CPAP. There was a statistical significance with usage of antenatal steroids and the outcome of the neonates. **Conclusion:**CPAP is the best mode of treatment in neonates with respiratory distress. Application of CPAP does not require trained personnel and can be set up by staff with minimal training. Downes score helped in subsequent assessment of distress. Also complications were very minimal while using CPAP.

Keywords: Respiratory distress, Downes score, CPAP.

INTRODUCTION

INTRODUCTION

Neonatal and perinatal mortality rates are the major indicators for the health status of the nation. In developed countries, the neonatal and perinatal mortality rates are 3–5 and 8–9 per 1000 live births respectively[1,2].

In India, despite remarkable progress in urban areas neonatal and perinatal mortality rates are still high.

The current neonatal mortality rate (NMR) in India is 30.92 per 1000 live births Many studies reveal that nearly half (32-52%) of this is due to respiratory distress in neonatal period[3,4]. Respiratory distress is one of the commonest problems of newborn occurring throughout the world (3-7% of all live births)[5-8].

In cases of respiratory distress -- adequate and immediate resuscitation, oxygen supplementation, maintenance of optimal temperature, timely referral and optimal ventilatory support will reduce the mortality and morbidity.

Assisted ventilation is one of the important methods in the management of respiratory distress in neonates. It is an acute, short term intervention to support the physical process of respiration partially or completely till the newborn is able to breathe unassisted.

RESPIRATORY DISTRESS:

Respiratory distress is a common cause of admission among neonates especially among preterm. Usual manifestations of respiratory distress in neonates are tachypnea, grunting, cyanosis, lethargy and refusal of feed, subcostal and intercostal retractions. Respiratory rate In a normal newborn is 30 to 60 breaths per minute.

Tachypnea is respiratory rate more than 60 breaths per minute. Tachypnea is a compensatory mechanism for hypercarbia, hypoxemia, and acidosis,[9] making it a common finding in a large variety of diseases. Pulmonary diseases may cause tachypnea, which is more common in neonates. The natural elastic property of the lungs is to inflate and deflate. When balanced by the recoil of the chest wall, functional residual capacity (FRC) occurs at the end of expiration to prevent alveoli from collapse. The chest wall of newborn, composed primarily of cartilaginous tissue, is more pliable and is more prone for pulmonary atelectasis and reduced FRC.

Pulmonary compliance is the change in volume (ΔVolume) for every given change in pressure (ΔPressure), the ability of the alveoli to fill with air over a set pressure. If lung compliance is reduced, such as with transient tachypnea of the newborn (TTN), respiratory distress syndrome (RDS), pneumonia, or pulmonary edema, there is a reduction in tidal volume of the lungs. To achieve required minute ventilation, the respiratory rate must increase. Hypoxemia further increases tachypnea. [9,10].Therefore, affected neonates present with marked tachypnea. As tachypnea is a nonspecific

symptom, additional clinical findings help in narrowing down the cause to a respiratory cause.

Increased work of breathing is caused from mismatched pulmonary mechanics from increased airway resistance , decreased lung compliance or both. Airway resistance increases when there is obstruction to air flow. The importance of airway radius is indicated in the equation $R = V(8l\eta/\pi r(4))$, where R is resistance, V is flow, l is length, η is viscosity, and r is radius.[11] If the airway radius is reduced by half, resistance increases by16-fold.

Nasal flaring is a symptom of th neonate that increases upper airway diameter and reduces resistance and therby work of breathing.

Retractions, are the use of accessory muscles in the neck, rib cage, sternum, or abdomen due to poor lung compliance or increased airway resistance.

Noisy breathing may indicate increased airway resistance, and the type of noise auscultated may help to localize the site of airway obstruction .

Stertor is a snoring sound heard over extrathoracic airways that indicates nasopharyngeal obstruction.

Stridor is a high-pitched, monophonic breath sound that indicates obstruction at the larynx, glottis, or subglottic area which can be inspiratory expiratory or both.

Grunting is an expiratory sound caused by sudden closure of the glottis during expiration in an attempt to maintain Functional Residual Capacity and prevent alveolar collapse.

Because lung compliance is poor at very low or very high FRC, maintaining physiologic FRC is essential in the management of respiratory disorders with poor compliance like RDS or TTN. On the other end, meconium aspiration syndrome (MAS) is a disease of lower airway obstruction with air trapping. These newborns have high lung volumes, which affects their lung compliance. If the newborn cannot sustain the increased work of breathing to meet its respiratory needs, respiratory failure ensues which requires ventilatory support. Without prompt intervention, respiratory arrest is imminent.

PATHOGENESIS:

There are various causes of respiratory distress in a newborn. Pulmonary causes may be due to changes during normal lung development or during transition to extrauterine life. Normal lung development generally occurs in 5 phases [12]. Respiratory disease may result from developmental abnormalities that occur either before or after birth. Early developmental malformations include tracheoesophageal fistula, bronchopulmonary sequestration (abnormal mass of pulmonary tissue not connected to the tracheobronchial tree), and bronchogenic cysts (abnormal branching of the tracheobronchial tree). Later in gestation, parenchymal lung malformations, including congenital cystic adenomatoid malformation or pulmonary hypoplasia from congenital diaphragmatic hernia or severe

oligohydramnios, may develop. More common respiratory diseases, such as TTN, RDS, congenital pneumonia, Meconium Aspiration Syndrome, and persistent pulmonary hypertension of the newborn (PPHN), result from complications during the prenatal to postnatal transition period. Although mature alveoli are present at 36 weeks' gestation, a large amount of alveolar septation and microvascular maturation occur postnatally. The lungs are not fully matures upto 2 to 5 years.[12,13]. Therefore, developmental lung disease can occur even after birth. Bronchopulmonary dysplasia (BPD), is a lung disease due to arrested alveolarization in developing lungs exposed to mechanical ventilation, oxygen, and other inflammatory mediators before normal development is complete. BPD affects up to 32% of premature infants and 50% of very low-birth-weight infants[14].

DIFFERENTIAL DIAGNOSIS OF RESPIRATORY DISTRESS IN NEWBORN:

AIRWAY:

Nasal obstruction, choanal atresia, micrognathia, Pierre Robin sequence, macroglossia, congenital high airway obstruction syndrome, including laryngeal or tracheal atresia, subglottic stenosis, laryngeal cyst or laryngeal web, vocal cord paralysis, subglottic stenosis, airway hemangiomas or papillomas, laryngomalacia, tracheobronchomalacia, tracheoesophageal fistula vascular rings, and external compression from a neck mass

PULMONARY:

Respiratory Distress Syndrome

Transient Tachypnea of New born,

Meconium Aspiration Syndrome,

Cogenital pneumonia,

Pneumothorax,

Persistent Pulmonary Hypertension,

Pulmonary hemorrhage.

CARDIOVASCULAR:

Congenital heart disease,

Cardiomyopathy

Cardiac Tamponade

Pericardial effusion

Cardiac failure.

THORACIC:

Pneumomediastinum

Chest wall deformities

Congenital Diaphragmatic Hernia

NEUROMUSCULAR:

Hypoxic-ischemic encephalopathy,

Cerebral malformations,

Chromosomal abnormalities,

Hemorrhage

Medications

Meningitis

Hydrocephalus

OTHERS:

Sepsis,

Metabolic abnormalities

Metabolic acidosis.

TRANSIENT TACHYPNEA OF NEW BORN(TTN) :

TTN is defined as presence of mild respiratory distress that occurs primarily in term and late preterm infants within 2 hrs of birth and resolves within 72 hrs. TTN is a common cause of respiratory distress in newborns due to delayed clearance of fluid from neonatal lungs. Normally in utero, the fetal airspaces and air sacs are fluid filled. For gas exchange to occur after birth, this fluid must be cleared from the alveolar spaces. At the end of gestation and before birth, the chloride channels in the lung epithelium are reversed so that fluid is absorbed and cleared from the lungs. This clearance is enhanced by labor, so that delivery before onset of labor increases the risk of retained fetal lung fluid in the alveoli [12]. Factors which increase the lung fluid clearance include antenatal corticosteroids, fetal thorax compression with uterine contractions, and release of fetal adrenaline, which enhances uptake of lung fluid[15].

TTN manifests as tachypnea and increased work of breathing, which persists for usually 24 to 72 hours. Chest radiographs reveal diffuse parenchymal infiltrates due to fluid in the interstitium (SUNBURST PATTERN), fluid in the interlobar fissure, and occasionally pleural effusions. Management is supportive. Infants may require supplemental oxygen, and continuous positive airway pressure (CPAP) is sometimes required to maintain alveolar integrity and for driving fluid into circulation. Blood gase analysis may show a mild respiratory acidosis with hypoxemia. The course of TTN is

self-limiting and usually does not require mechanical ventilation.

PROLONGED RESPIRATORY TRANSITION:

Prolonged respiratory transition (PT) is defined as the presence of respiratory distress at birth that usually improves with the use of CPAP within 6 hours of birth.

RESPIRATORY DISTRESS SYNDROME:

RDS is the presence of signs of respiratory distress within the first 6 hours of life, usually in preterm neonates with characteristic radiological findings that persist for more than 2–3 days.

Respiratory distress Syndrome, is a common cause of respiratory distress in premature neonates especially below 32 weeks. RDS is also seen in infants of mothers with gestational diabetes mellitus. RDS is caused by a deficiency of surfactant in the alveoli, which increases the surface tension of the alveoli, causing microatelectasis and thereby reduces the lung volume. Surfactant deficiency manifests as diffuse fine granular infiltrates causng epithelial injury of the airway, decreased concentration of sodium-absorbing channels in the lung epithelium, and a relative oliguria in the first 2 days of life.[16]. They improve with the onset of diuresis around fourth day of life.

Infants with respiratory distress present within the first few hours of life. Clinically, neonates have respiratory distress in the form of tachypnea, grunting, nasal flaring and

intercostal, subcostal, and suprasternal retractions. Grunting occurs when the neonate tries to maintain an adequate FRC in the poorly compliant lungs by partial glottic closure. As the neonate prolongs the expiratory phase of respiration against the partially closed glottis, there is increased residual volume that maintains the airway opening which causes an audible expiratory sound. Mild RDS may respond to the distending pressures of CPAP, but severe RDS may require endotracheal intubation and administration of exogenous surfactant into the lungs. Sometimes administration of prophylactic surfactant in the first 2 hours of life for all premature infants younger than 30 weeks' gestation is also found to be beneficial. Beginning with noninvasive ventilation (CPAP) and reserving intubation and surfactant administration only for infants who require more than 35% to 45% oxygen concentration to maintain an arterial PaO2 greater than 50 mm Hg also gives good results. It is important to consider the administration of antenatal corticosteroids, the clinical presentation, radiographic findings, and the infant's oxygen requirements to derive at the management protocol.

RDS improves by 3 to 4 days of life during the diuresis phase and as the infant begins to secrete endogenous surfactant. Mechanical ventilation before this stage should be usedwith caution to avoid ventilator-induced lung injury. Neonates who do not improve with surfactant administration should be screened for the presence of a patent ductus arteriosus or other congenital heart disease. The neonates who initially improve with administration of surfactant and subsequently deteriorates should also be evaluated for

ventilator associated pneumonia. On admission, it is appropriate to start antibiotics in the newborn with RDS because pneumonia may have similar clinical presentation and chest radiographs features may also be indistinguishable from RDS.

Preventing premature birth will reduce the incidence of RDS. To benefit those infants who will deliver prematurely, multiple randomized clinical trials strongly support the use of maternal antenatal corticosteroids. Two doses of betamethasone 12 mg ,24 hrs apart or dexamethasone 6mg , 12 hrs apart , 4 doses reduce the incidence of RDS, intraventricular hemorrhage, and mortality in neonates between 28 to 34weeks gestation.[17,18,19].

SCORING:

Various scoring systems are available to clinically assess respiratory distress.

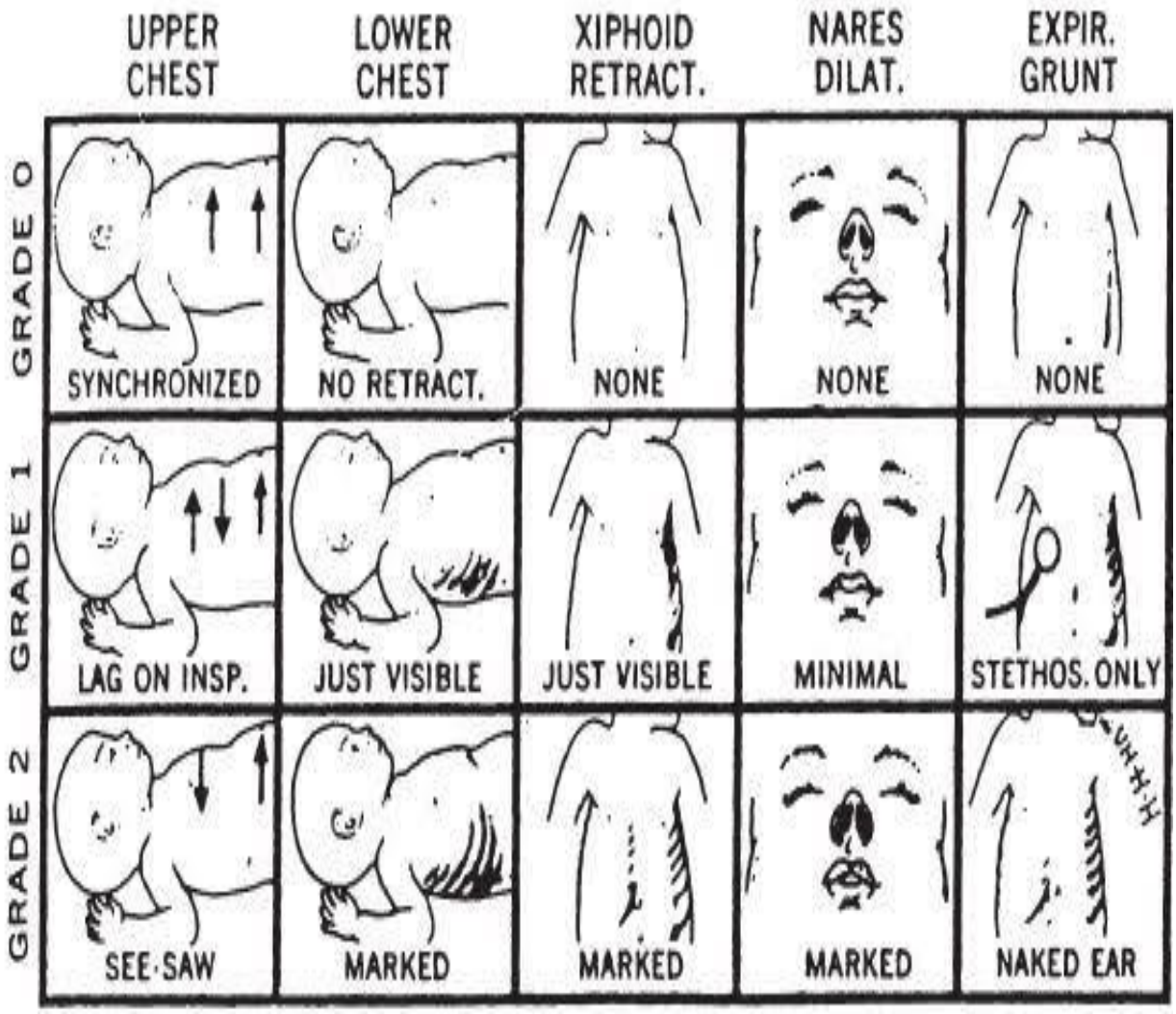
DOWNES SCORE FOR TERM BABIES:

Downes' Scoring system

	0	1	2
Cyanosis	None	In room air	In 40% FIO2
Retractions	None	Mild	Severe
Grunting	None	Audible with stethoscope	Audible without stethoscope
Air entry	Clear	Decreased or delayed	Barely audible
Respiratory rate	<60	60-80	>80 or apnea

Score:
> 4 = Clinical respiratory distress; monitor arterial blood gases
> 8 = Impending respiratory failure

SILVERMAN ANDERSON SCORE FOR PRETERM BABIES:



TOTAL SCORE: 1-3 Mild respiratory distress.

3-6 Moderate respiratory distress.

7-10 Severe respiratory distress.

TYPES OF VENTILATION:

There are two basic types of assisted ventilation.

1. Invasive ventilation

2. Non-Invasive ventilation

INVASIVE VENTILATION:

The discovery of mechanical ventilation was one of the major interventions, which provided life saving support for neonates with respiratory failure. Along with advancements, like administration of antenatal corticosteroids and surfactant therapy, mechanical ventilation has led to increased neonatal survival, especially for preterm neonates less than 30 weeks gestational age with immature lung function.

Even though mechanical ventilation can be lifesaving, it may lead to chronic lung injury resulting in broncho pulmonary dysplasia (BPD), a major complication of prematurity. As a result, efforts have been made to develop new technology, like usage of early continuous positive airway pressure (CPAP) in preterm infants at risk for neonatal respiratory distress syndrome (RDS) and strategies are undertaken for neonatal ventilator care to maintain adequate gas exchange and mininimize lung injury.

Invasive ventilation (although potentially lifesaving) is one of theZmore expensive therapies in neonatal intensive care. And it is not free of associated morbidity (higher incidence of bronchopulmonary dysplasia and retinopathy of prematurity in preterm infants and more chance for hospital acquired

infection). It requires highly skilled medical personnel to operate and monitor the baby with frequent blood sampling (e.g.-ABG monitoring).Another difficult task which decides upon the outcome of the baby is nursing care which is of utmost importance and requires adequate training of the staff.

NON INVASIVE VENTILATION:

Gentle Non-Invasive ventilation like Bubble CPAP has many advantages. Bubble CPAP is relatively simple and inexpensive. With pulseoximeter monitoring, these neonates can be effectively managed[20]. The long term morbidity is also less in Bubble CPAP, without any significant difference in mortality (Avery et al-1987)[21]. With trained persons it can be used in all secondary level hospitals to serve the purpose of large number of neonates in developing countries like India[22,23]. This sort of low cost interventions are the most cost effective method to reduce morbidity and mortality.

DISADVANTAGES OF INVASIVE VENTILATON IN RESPIRATORY DISTRESS:

Prolonged use may cause

Upper airway damage

Volutrauma

Barotraumas

BPD

Infection

Alveolar collapse

ADVANTAGES OF NONINVASIVE VENTILATION IN RESPIRATORY DISTRESS:

Continuous positive airway pressure is a method of providing Positive End Expiratory Presssure with desired flow of oxygen to a spontaneously breathing neonate to maintain adequate lung volume during expiration and thereby preventing alveolar collapse[24,25,26]. Thus CPAP maintains the Functional Residual Capacity [27,28,29]. of the lung and prevents the respiratory muscles from fatigue.

DEVELOPING WORLD AND CPAP:

Many infants with higher mortality and morbidity are denied ntensive care as the financial resources are directed towards more viable infants. A randomized control study by Piper et al in South Africa showed that infants treated with CPAP had a better outcome than those treated with oxygen head boxes. However initially setting up a CPAP required trained personnel but the nowadays it was proved than it can also be set by nursing staff with minimal training thus helping for the long term survival of the infants[30]..

CONTINUOUS POSITIVE AIRWAY PRESSURE:

CPAP was first used in 1971 to prevent distress in preterm neonates by Gregory et al .Dr.JenTienWung at Columbian Medical Center New York introduced Bubble CPAP using prongs[31]. In 1987 Avery et al published a retrospective study of 1625 neonates at 8 tertiary care centres[32]. which showed nasal CPAP reduced the incidence of Chronic Lung Disease without much difference in mortality.

Bubble CPAP (B-CPAP) and ventilator-derived CPAP (V-CPAP) are the commonly used CPAP modes. In V-CPAP, a variable resistance in a valve is adjusted to provide resistance to the flow of air[33]. In B-CPAP the positive pressure in the circuit is achieved by simply immersing the distal expiratory tubing in a water column to a desired depth rather than using a variable resistor [34,35].

Bubble CPAP provides continuous pressure that helps the collapse of alveoli on expansion, thereby increasing lung functional residual capacity and decreasing breathing work in neonates with respiratory distress. Moreover, bCPAP is relatively inexpensive and easy-to-use; accordingly, it is gaining popularity in developing countries as the method of choice for delivering CPAP to distressed neonates.[36,37]. bCPAP can be used to manage various respiratory conditions in the newborn, including respiratory distress syndrome (RDS), transient tachypnea of the newborn (TTN), meconium aspiration, congenital pneumonia, pulmonary edema, and apnea[38]. It can also be used in neonates when weaned from intubation to support the respiratory system and decrease the rate of reintubation[39].

During pre surfactant era when antenatal steroids were not in much use, evidence showed that application of CPAP reduces the subsequent usage of mechanical ventilation.

BENEFITS OF CPAP[40]:

- Reduces upper airway obstruction by reducing upper airway resistance and increasing pharyngeal cross sectional area.
- Reduces apnea due to obstruction
- Increases Functional Residual Capacity
- Reduces right to left shunting
- Increases tidal volume and compliance of stiff lung
- Reduces work of breathing
- Regularizes respiratory rate
- Conserves surfactant
- Reduces edema of alveoli
- Reduces respiratory resistance by dilating the upper airways
- CPAP after extubation reduces the need for re-ventilation.
- Improves oxygenation and carbon di oxide elimination.

CPAP requires three components:

I. Flow generation

II. Airway interface

III. Positive pressure system

FLOW GENERATION:

Flow generators warms and humidifies the inhaled gases which prevents mucosal damage .

Two types:

i. Constant flow

ii. Variable flow

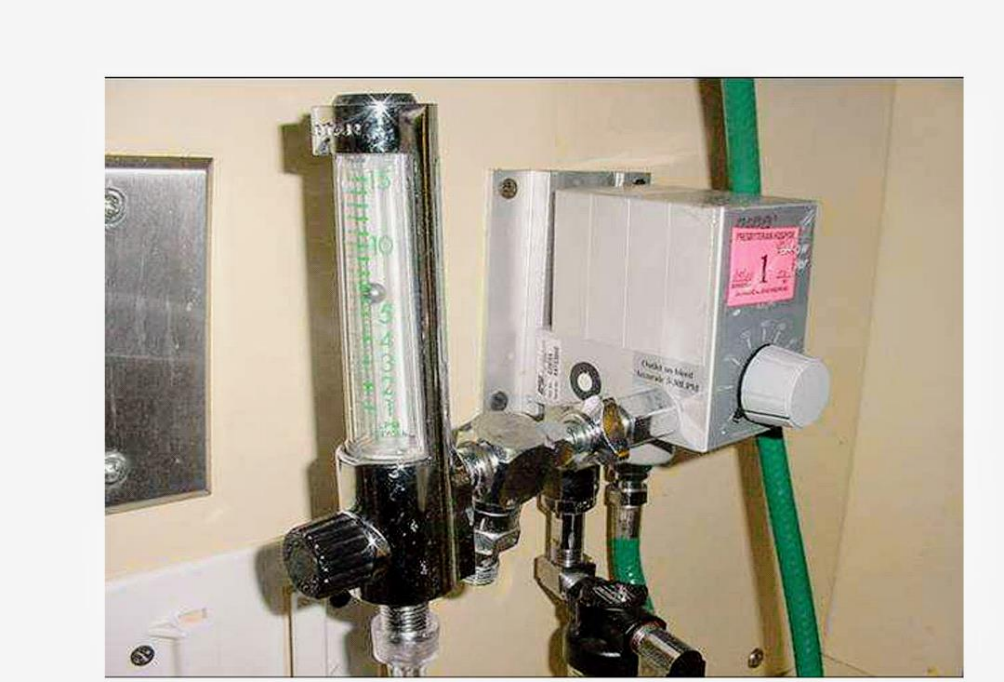
Constant Flow:

This is provided by an infant ventilator where the amount of flow is set by the clinician.

Variable Flow:

In this,the expiratory limb of the circuit is open to the atmosphere and the neonate can draw gas from this limb to support inspiration.

FIGURE 1: OXYGEN FLOW GENERATOR WITH BLENDER:

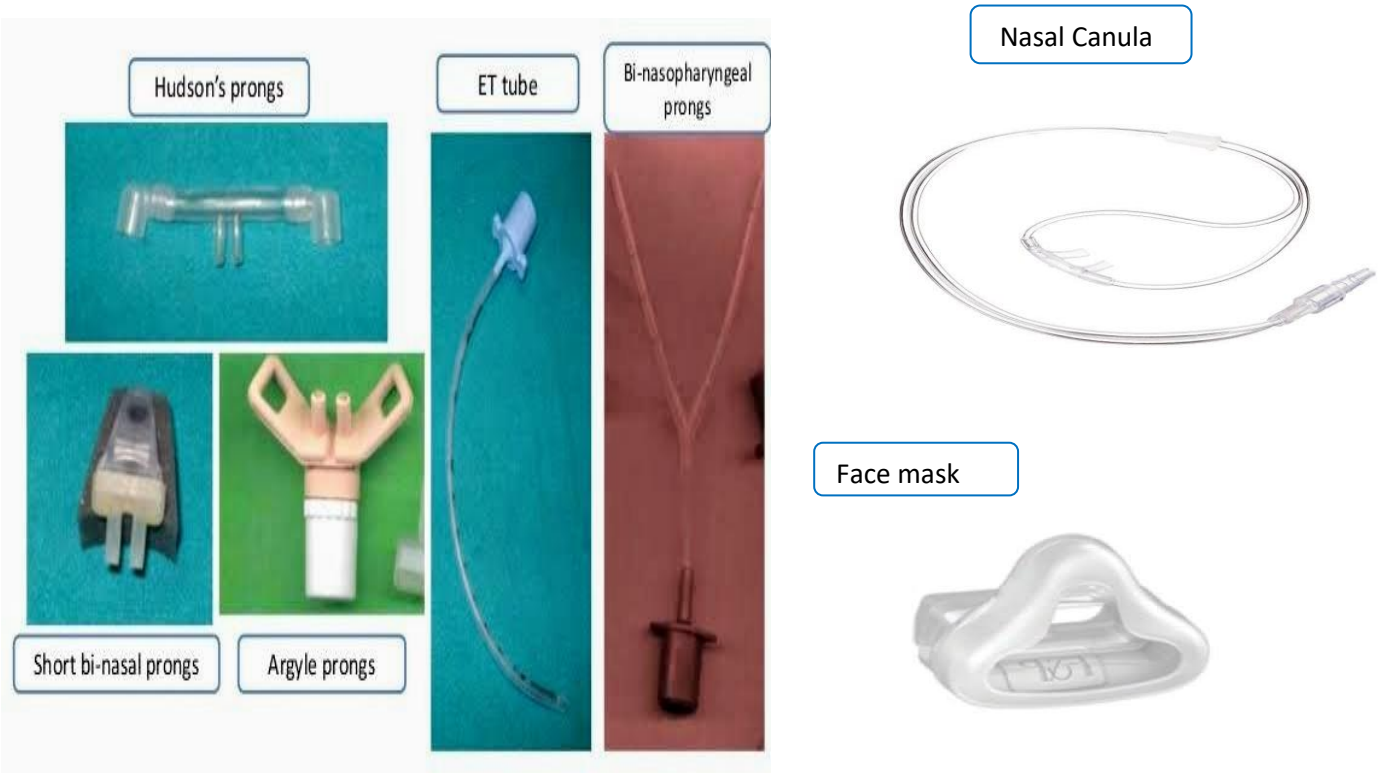


AIRWAY INTERFACE:

- Single nasal prongs

- Binasal prongs
- ET tubes
- Nasopharyngeal prongs
- Pressurised plastic bags
- Head boxes
- Face masks
- Nasal canulae

FIGURE 2: TYPES OF AIRWAY INTERFACES:



Out of these, nasal canulae are considered a better mode as the babies can be fed during treatment. Reviews prove that they prevent incidence of re intubation in preterm infants.However they cause nasal injury in the form of excoriation and scars[41,42,43].

POSITIVE PRESSURE SYSTEM:

Can be generated by adusting the expiratory valve in case of a ventilator CPAP. Or by immersing the far end of the expiratory tube into water in case of a bubble CPAP.

FIGURE 3: BUBBLE CPAP GENERATOR

INDICATIONS OF BUBBLE CPAP:

- Signs of significant respiratory distress (2 or more)
    - Tachypnoea
    - Flaring
    - Grunting
    - Retractions
    - Cyanosis
    - O_2 requirement
- Diseases with low functional residual capacity (FRC)
    - RDS
    - TTN
    - Pulmonary oedema
- Meconium Aspiration Syndrome
- Airway closure disease
    - BPD
    - Bronchiolitis
    - Apnoea and bradycardia of prematurity
- Weaning from mechanical ventilation
- Tracheomalacia
- Diaphragmatic paralysis

- Atelectasis
- Pulmonary haemorrhage

CONTRAINDICATIONS OF CPAP:

Congenital anomalies like:

- Diaphragmatic hernia
- Choanal atresia
- Tracheo-oesophageal fistula
- Gastroschisis
- Pneumothorax without chest drain
- Cardiovascular instability is a relative contraindication as intubation and ventilation may allow better stabilization

COMPLICATIONS OF CPAP:

Nasal Septal Erosion or Necrosis	1. This is preventable when appropriate sized prongs are used and are correctly positioned.
Pneumothorax	1. Usually occurs in acute phase. 2. It is uncommon (<5%). 3. It usually results from the underlying disease process rather than positive pressure alone. 4. It is not a contraindication to the use of CPAP.
Abdomen distension from Swallowing Air	1. This is benign 2. Easily reduced with gastric drainage or aspiration
Nasal obstruction	1.From improper prong placement or inadequate airway care

,

CPAP FAILURE:

Failure of CPAP therapy is defined as the need for endotracheal intubation or escalation of therapy to NIPPV due to the persistence of severe respiratory distress signs and the need for a high oxygen concentration (>60%) despite CPAP therapy with a pressure of 6 cm H_2O.

Failure of B-CPAP is defined as:

1. Requirement of pressure >8cmH2O
2. FiO2 requirement >o.6
3. PaO2 < 50mmg with maximum settings
4. PaCO2>60mmHg and PH <7.2 with maximum settings
5. Air leak on bubble CPAP
6. Recurrent apnea on bubble CPAP despite caffeine citrate

CPAP failure can be prevented to a some extent by using delivery room CPAP(T piece resuscitator) during the shifting process of the neonate from labour room to NICU thereby preventing alveolar collapse soon after birth. This also helps in early rescue therapy with surfactant by keeping the lungs compliant and also prevents impeding respiratory failure due to increased respiratory distress.

FIGURE 4:BUBBLE CPAP (1)

Bubble CPAP consists of three components:

1.Continuous gas flow to the circuit.

2.Expiratory limb, the end of which is inserted into a container with water thereby generating positive pressure system

3.Interface which connects baby's airway to the circuit.

When the gas leaves the circuit through the expiratory limb, it produces bubbles.Oxygen blender blends the oxygen and compressed air to provide inspired oxygen at appropriate concentration[33,44,45]. Optimal gas flow will be maintained by a flow meter which prevents rebreathing of CO2 , increased work of breathing due to insufficient flow available for inspiration and also compensated for leakage .Flow rate can be set between 5 to 10 litres for a neonate[34,46].

FIGURE 5: BUBBLE CPAP (2)

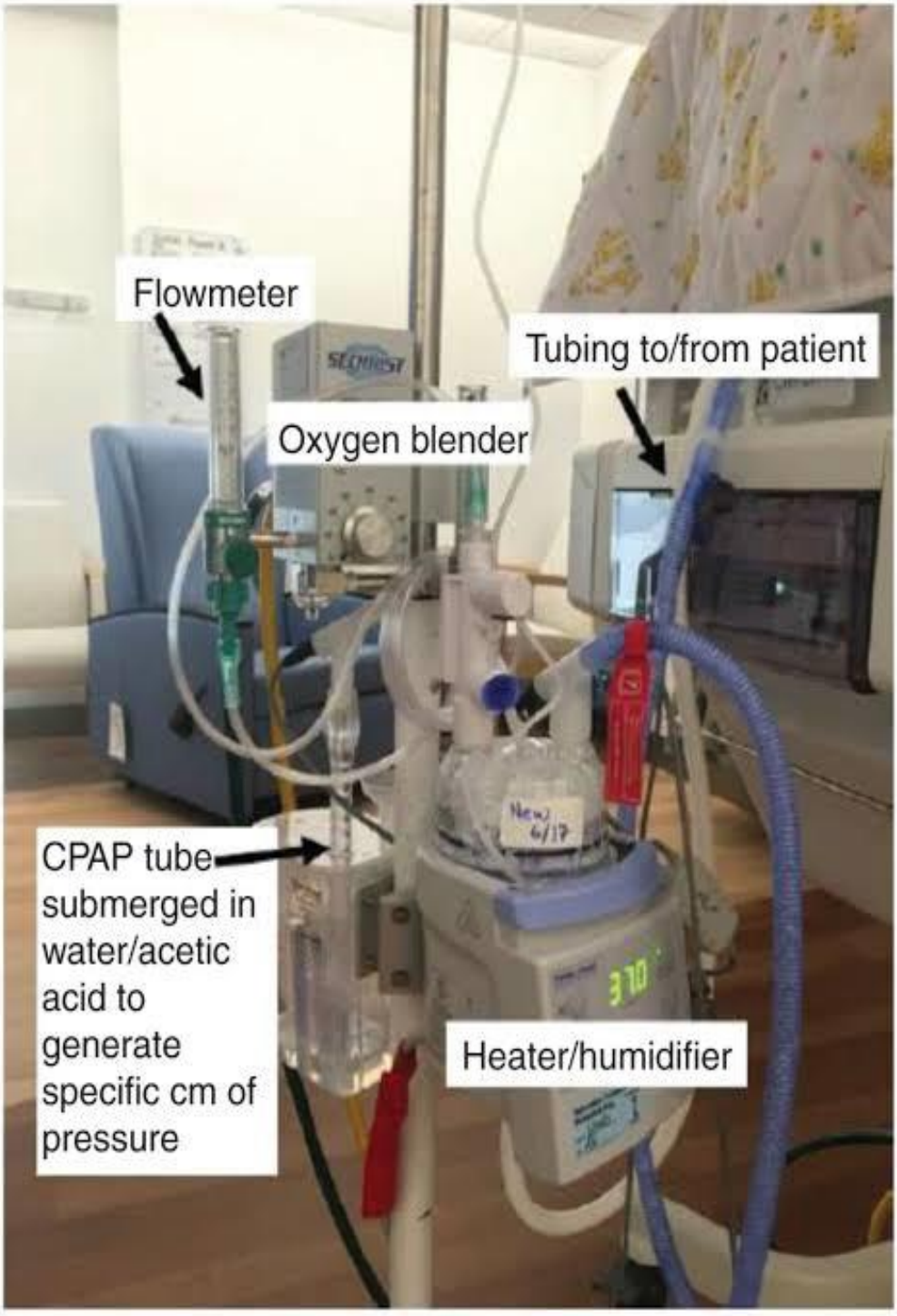


FIGURE 6: BUBBLE CPAP (3)

Pressure can be generated by immersing the distal end of the expiratory tubing into water. When the pressure generated is adequate without any leakage it will produce continuous bubbles and the pressure oscillates in the circuit. However leakage cannot be well appreciated in a ventilatorCPAP.Though pressureoscillation was once thought to support gas exchange,this was not supported in recent studies[47,48].

CPAP is effective in a variety of neonatal conditions. Nowadays it has proved to be a better alternative to mechanical ventilation in the management of HMD neonates. CPAP with a short duration of ventilation along with early dose surfactant has increased the outcome in neonates with moderate to severe RDS[49,50].

This technique is termed as INSURE technique (INtubation ,SUrfactant administration, Rapid Extubation.)

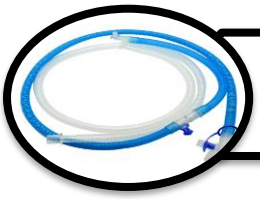
Administration of surfactant within 6 hrs of birth along with early application of nasal CPAP in neonates with respiratory distress has significantly reduced the neonatal mortality and has increased the survival rate of the neonates.

EQUIPMENTS REQUIRED:

Container filled with sterile water(0.25% acetic acid) to a depth of 10 cm

Vertical column fitting through the lid with a scale graduated form 0-10 cm

Oxygen source,flow meter,blender oxygen tubing.



Inspiratoty and expiratory circuits.

Heater and humidifier

Nasal prongs/mask with bonnet

SETTING UP A CPAP:

FIGURE 7: EXPIRATORY LIMB

The container is filled with water upto 10cm H2O and place below the level of the neonate . The vertical column should be fitted into the lid of the container and immersed at a level of desired pressure initially at 4-6 cm of H2O.The expiratory circuit from the neonate is connected to this column. Expiratory tube will require a port with tubing connecting to a calliberated manometer. Nasal prongs /mask of appropriate size which are snuggly fitting are secured with a bonnet.Bonnets of various sizes available should be appropriately chosen. Inspiraory circuit is connected to the oxygen supply,flow meter,blender and a humidifier.. The oxygen flow can be started from 6L per minute and increased appropriately to produce a steady stream of bubbles in the container with water. The column can be lowered or raised to a desired pressure to produce steady bubbling.

FIGURE 8 : WATER FILLED CONTAINER

MONITORING:

CPAP requires proper care to neonates airway. Excessive flexion or extension should be avoided by choosing the appropriate prong size and proper positioning of neonates neck.inhaled gas should be adequately humidified to avoid mucosal damage. Also secretions should be frequently suctioned.

FIGURE 9: NASAL SUCTIONING

Gaseous distension of the bowel should be decompressed using a orogastric tube. Infants should also be monitored for nasal damage and other complications like pneumothorax and air embolism[51,52] through proper clinical training.Monitors and temoerature probes should be used for checking for desaturaturation and hypothermia.

NURSING CARE:

Adequate nursing care is essential for the success of bubble CPAP. Proper positioning of the prongs is accomplished by choosing appropriate cap size which rests on the lower part of babys ears and across his forehead with the circuit fastened over it. Aim is to SNUGGLY FIX the prongs into the babys nostrils.

FIGURE 10: SNUGGLY FITTING INTERFACE:

Tissue necrosis was also noted when the prongs were not properly fit in an actively moving infant.

Consistent bubbling is required to recruit the alveoli ,to reduce airway resitance and to maintain the functional residual capacity.cwhen the bubble stops it indicates pressure usually around the nostrils.also there is a marked fall in pharyngeal pressure when a CPAP supported infant keeps the mouth open. This can be avoided by using a chin strap or a pacifier which ensures adequate mouth closure. However this should not restrict the infant from crying or yawning.

Orogastric tube insertion prevents abdomen distension and provides decompression thereby preventing CPAP BELLY SYNDROME

.

FIGURE 11: OROGASTRIC TUBE INSERTION

Respiratory status of the child is assess as when required to decide upon the next level of management and plan for weaning from CPAP. CPAP should be discontinued during auscultation as the bubbling may interrupt with auscultatory findings. However infant should watched for apnea or bradycardia during this brief period of discontinuation of CPAP.

REVIEW OF LITERATURE

REVIEW OF LITERATURE:

According to a study on EFFICACY AND SAFETY OF CPAP IN LOW AND MIDDLE INCOME COUNTRIIES, America, from the Journal of Perinatology (2016), it was concluded that CPAP is a safe and effective mode of therapy in preterm neonates with respiratory distress, It reduces the in-hospital mortality and the need for mechanical ventilation by 66%, thereby minimizing thetransfer to a referral hospital[53].

Another study on Continuous Positive Airway Pressure in Preterm Neonates: An Update of Current Evidence and Implications for Developing Countries by the Departments of Pediatrics, AIIMS Jodhpur; PGIMER, Chandigarh; Fernandez Hospital Hyderabad and AIIMS, New Delhi, India it was analysed that early use of CPAP is the ideal approach for preterm and extremely preterm infants with respiratory distress, . Delivery room CPAP is easy to use and reduces the need for surfactant administration and need for mechanical ventilation by nearly 50%[54].

A prospective observational study on Outcome of Early Cpap in the Management of Respiratory Distress Syndrome (RDS) in Premature Babies with ≤32 Weeks of Gestation,,conducted in a tertiary care centre in Kochi Kerala(2015) showed that Early institution of CPAP in the management of RDS in premature neonates, can significantly reduce the need for mechanical ventilation (MV) and surfactant therapy, with minimum associated complications like Bronchopulmonary dysplasia[55].

An observational study on Outcome of Bubble (CPAP) Continuous Positive Airway Pressure in Neonates with Respiratory Distress and its failure factors, conducted in government general hospital at Guntur showed that Bubble Continuous Positive Airway Pressure is safe to use in preterm and term neonates with mild to moderate Respiratory Distress with a success rate of 64%[56].

A prospective analytical study was conducted on preterm neonates of 28 to 36 weeks gestational age with mild to moderate Respiratory Distress Syndrome admitted in level 2 of NICU in Bangalore, India, from November 2011 to May 2013. Downes score (DS) was used to assess the severity of respiratory distress. Effectiveness of CPAP was analysed using Downes Score and the fraction of

inspired oxygen (FiO2) requirement. BCPAP was effective in 91% of the preterm neonates under study between gestational age 28 and 36 weeks with mild to moderate RDS in level 2 NICU in Bangalore, India[57].

A population-based cohort study was conducted in 696,816 live born neonates of more than or equal to 24 weeks gestation in New South Wales (NSW) Australia, 2001-2008. The primary outcome was better in using CPAP than using mechanical ventilation. Analyses were classified according to age ≤32 and > 32 weeks gestation. Recommendations are required regarding which neonates should be considered for CPAP, resources which are necessary for a unit to offer CPAP and for monitoring of long term outcome[58].

AIMS AND

OBJECTIVES

AIM AND OBJECTIVE:

- To study the clinical profile and outcome of non invasive ventilation using BUBBLE CONTINUOUS POSITIVE AIRWAY PRESSURE in neonates with respiratory distress in a tertiary care centre.

MATERIALS AND METHODS

MATERIALS AND METHODS:

STUDY DESIGN

Prospective study

STUDY PLACE:

Government Mohan Kumaramangalam Medical College and Hospital, Salem, Tamilnadu

STUDY PERIOD:

November 2018 to October 2019

STUDY POPULATION:

First 200 Term and Preterm Neonates admitted in NICU in view of respiratory distress during the study period .

INCLUSION CRITERIA:

- Neonates with respiratory distress [DOWNES SCORE 4 to 6].
- Neonates with Oxygen Saturation [SPO2] < 85% even with supplemental oxygen.

EXCLUSION CRITERIA:

- Babies with severe respiratory distress[DOWNES SCORE>7/10].
- Unstable cardiovascular status.
- Prolonged and refractory seizures.

- Major congenital anamolies including airway anamolies ,pulmonaryhypoplasia.diaphragmatic hernia.

METHODOLOGY:

DOWNES SCORE

	0	1	2
Cyanosis	None	In room air	In 40%FIO2
Retractions	None	Mild	Severe
Grunting	None	Audible with stethoscope	Audible without stethoscope
Air entry	Clear	Decreased or delayed	Barely audible
Respiratory rate	Under 60	60-80	Over 80 or apnea

Score:
>4= Clinical respiratory distress; monitor arterial blood gases
>8=Impending respiratory failure

4

Here we used Downes score at the time of admission to assess respiratory distress. A score of 3-6 were considered for application of CPAP and those with a score of above 6 indicated impending respiratory failure requiring intubation and mechanical ventilation.

Date and time of application of CPAP was noted. Necessary nursing care and suctioning were given appropriately. Neonates were assessed every 4 hrs after application of CPAP for improvement in respiratory distress and Downes score was calculated. Reduction in Downes score was used as an indicator to wean the neonate from CPAP. Whereas increase in Downes score indicated the requirement of mechanical ventilation.

Data was analyzed using SPSSv.24 . All categorical data was summarized using frequency and percentages,all continuous data was described using mean and standard deviation. To study the association of clinical parameters between survivors and Non survivors, independent sample t test was applied for the continuous measurements after checking normality assumption and Chi square test or Fishers exact test was applied for categorical observations based on the expected frequency. P-value was considered significant at 5% level of significance for all comparisons

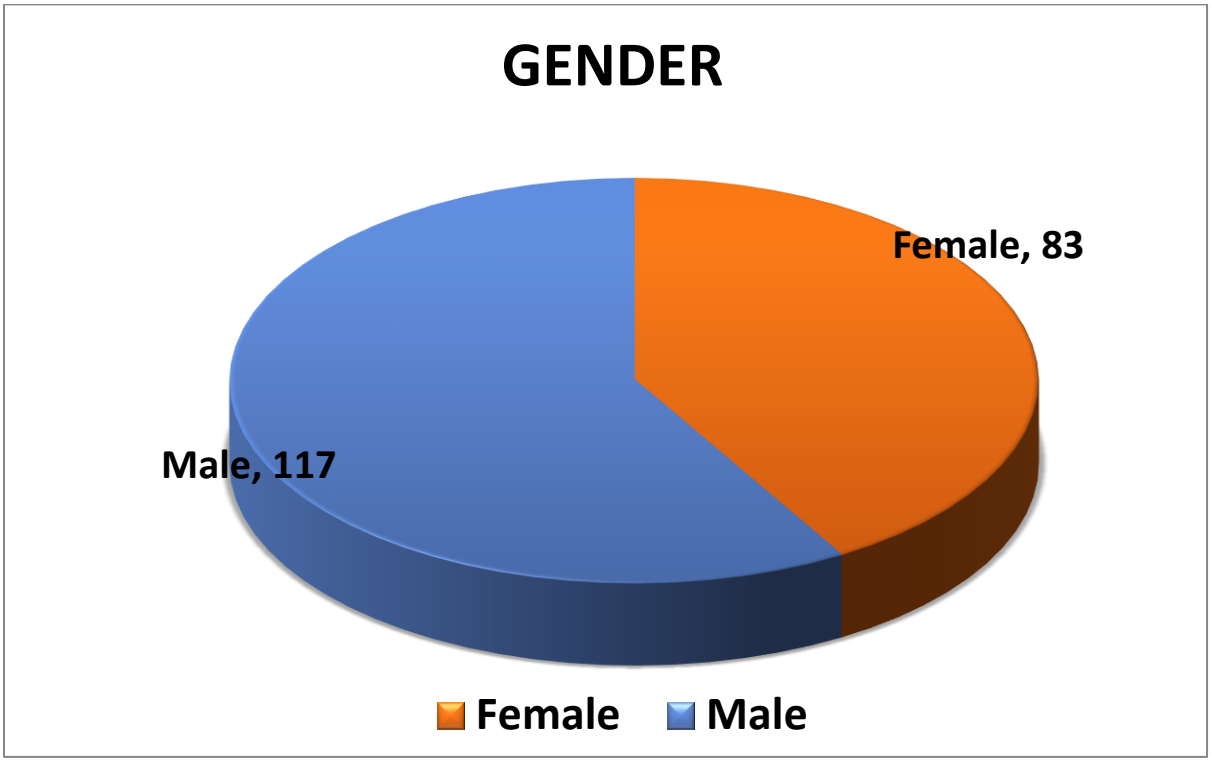
OBSERVATION AND RESULTS

Out of the 200 babies analyzed 58.5% babies were male babies and 41.5% babies were female babies.

TABLE 1: GENDER

GENDER	FREQUENCY n=200	PERCENTAGE (%)
FEMALE	83	41.5
MALE	117	58.5
TOTAL	200	100.0

FIGURE 12:

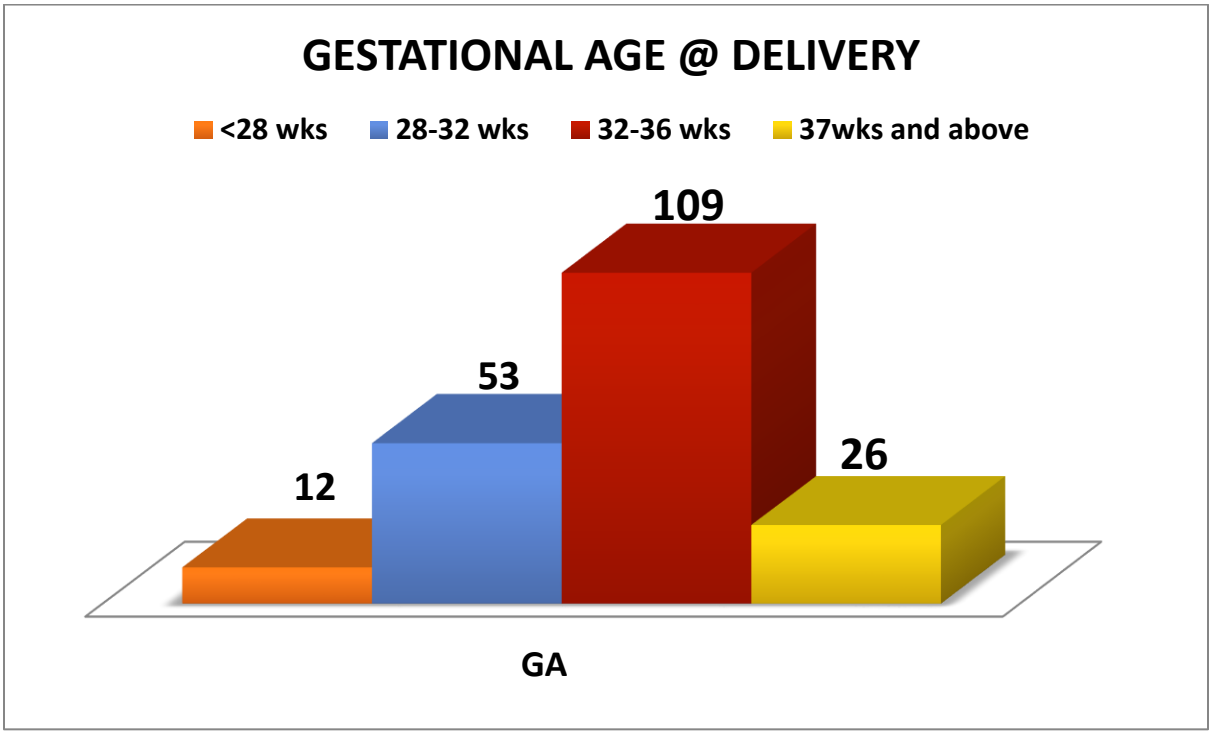


As per the gestational age 6% babies were less than 28 weeks, 26.5% babies were between 28 to 32 weeks, 54.5% babies were between 32 and 36 weeks and 13% babies were above 37 weeks.

TABLE 2: GESTATIONAL AGE AT DELIVERY

GESTATIONAL AGE	FREQUENCY n=200	PERCENTAGE (%)
<28 WKS	12	6.0
28-32 WKS	53	26.5
32-36 WKS	109	54.5
37WKS AND ABOVE	26	13.0
TOTAL	200	100.0

FIGURE 13:

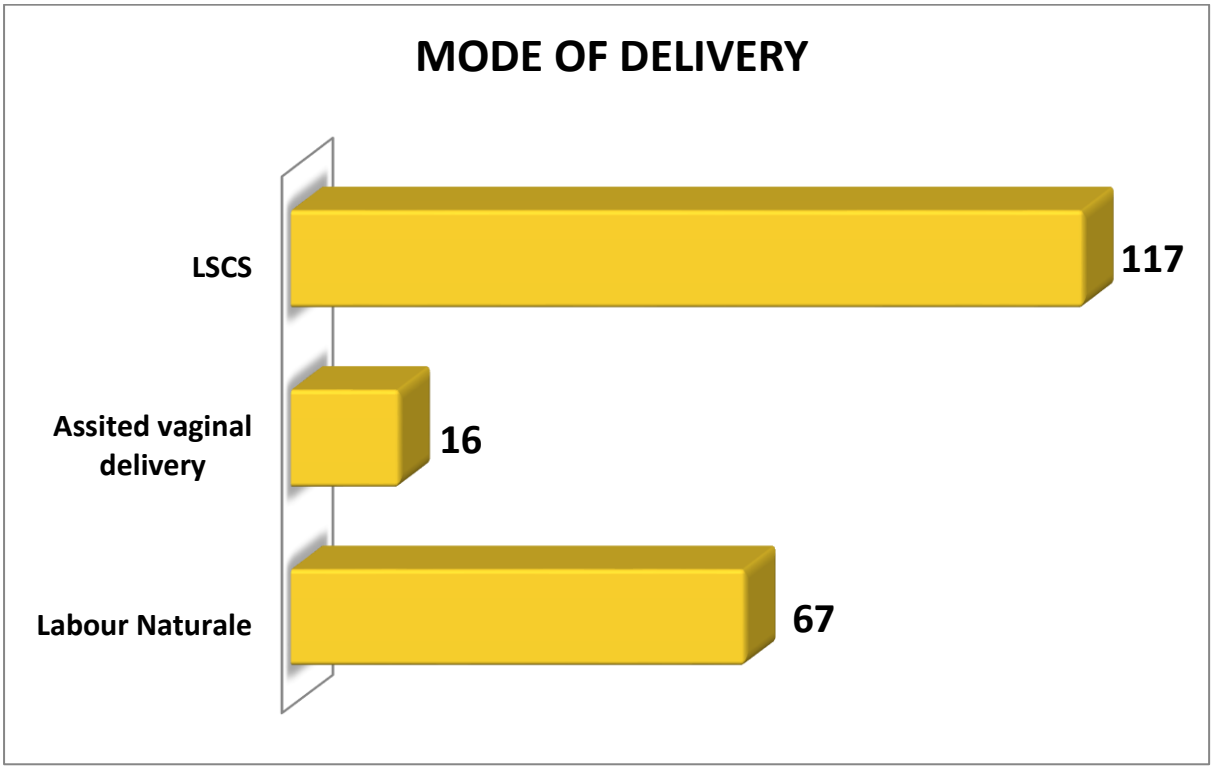


Regarding mode of delivery , 33.5% were delivered by labour naturale, 8% were delivered by assisted vaginal delivery [forceps or vaccum] and 58.5% babies were delivered by LSCS.

TABLE 3: MODE OF DELIVERY

MODE OF DELIVERY	FREQUENCY n=200	PERCENTAGE (%)
LABOUR NATURALE	67	33.5
ASSITED VAGINAL DELIVERY	16	8.0
LSCS	117	58.5
TOTAL	200	100.0

FIGURE 14:

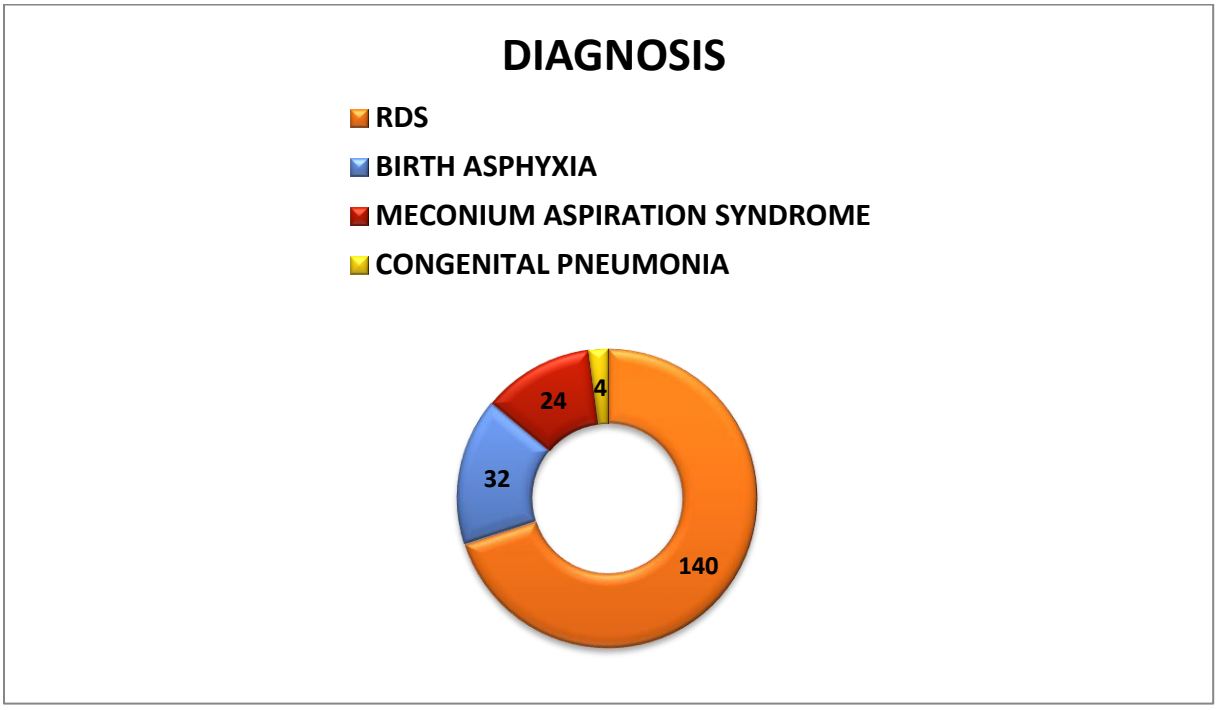


Respiratory distress was due to various causes 70% babies were diagnosed to have Respiratory Distress Syndrome.16% babies were admitted in view if Birth Asphyxia.12% babies were diagnosed to have Meconium Aspiration Syndrome and 2% babies had Congenital Pneumonia.

TABLE 4: DIAGNOSIS

DIAGNOSIS	FREQUENCY n=200	PERCENTAGE (%)
RESPIRATORY DISTRESS SYNDROME	140	70.0
BIRTH ASPHYXIA	32	16.0
MECONIUM ASPIRATION SYNDROME	24	12.0
CONGENITAL PNEUMONIA	4	2.0
TOTAL	200	100.0

FIGURE 15:

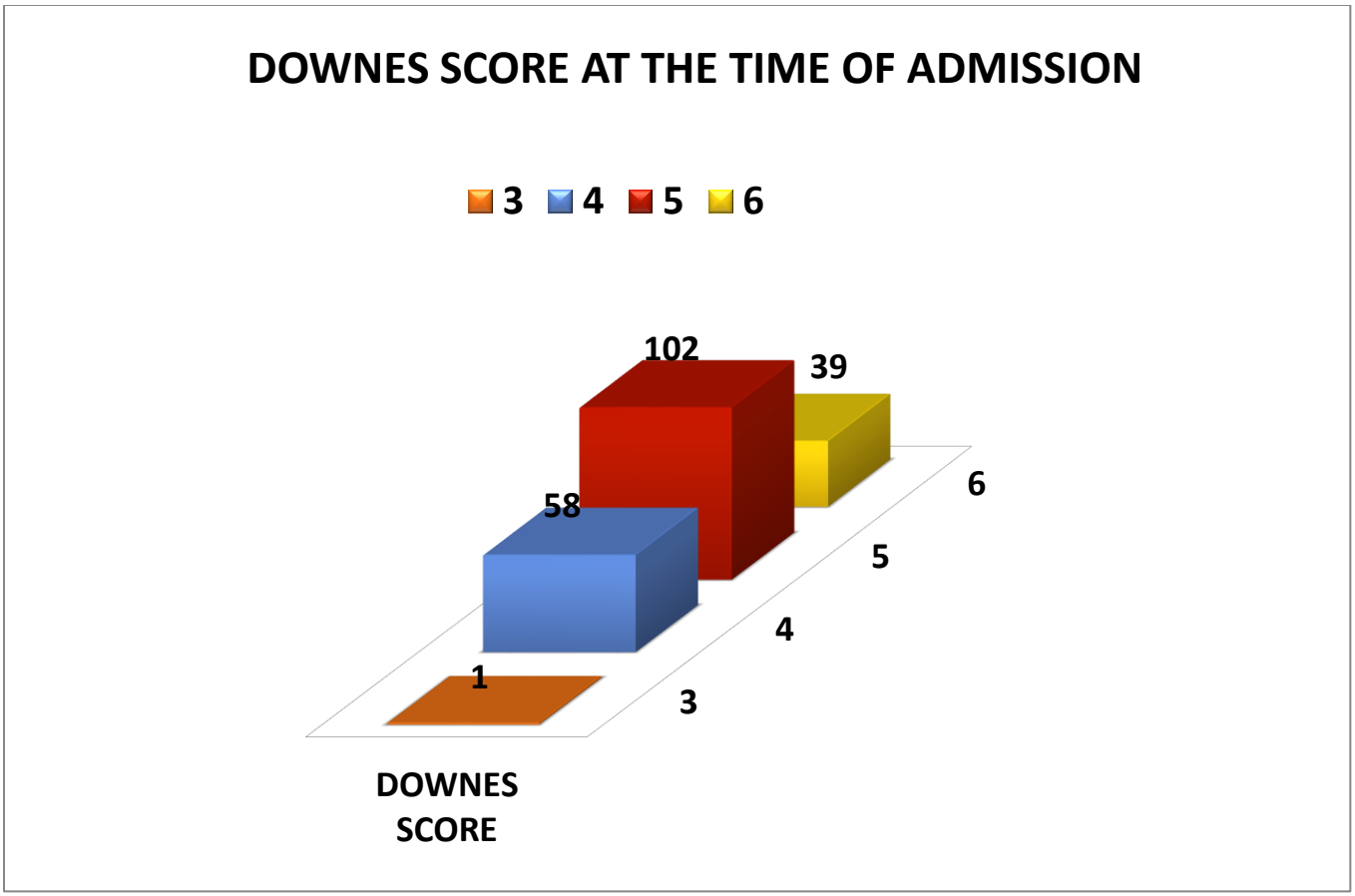


0.5% babies had a Downes score of **3**at the time of admission, whereas 29% babies had a score of **4**, and 51% babies had a score of **5** and 19.5% babies had a score of **6**.

TABLE 5: DOWNES SCORE

DOWNES SCORE AT THE TIME OF ADMISSION	FREQUENCY n=200	PERCENTAGE (%)
3	1	0.5
4	58	29.0
5	102	51.0
6	39	19.5
TOTAL	200	100.0

FIGURE 16:

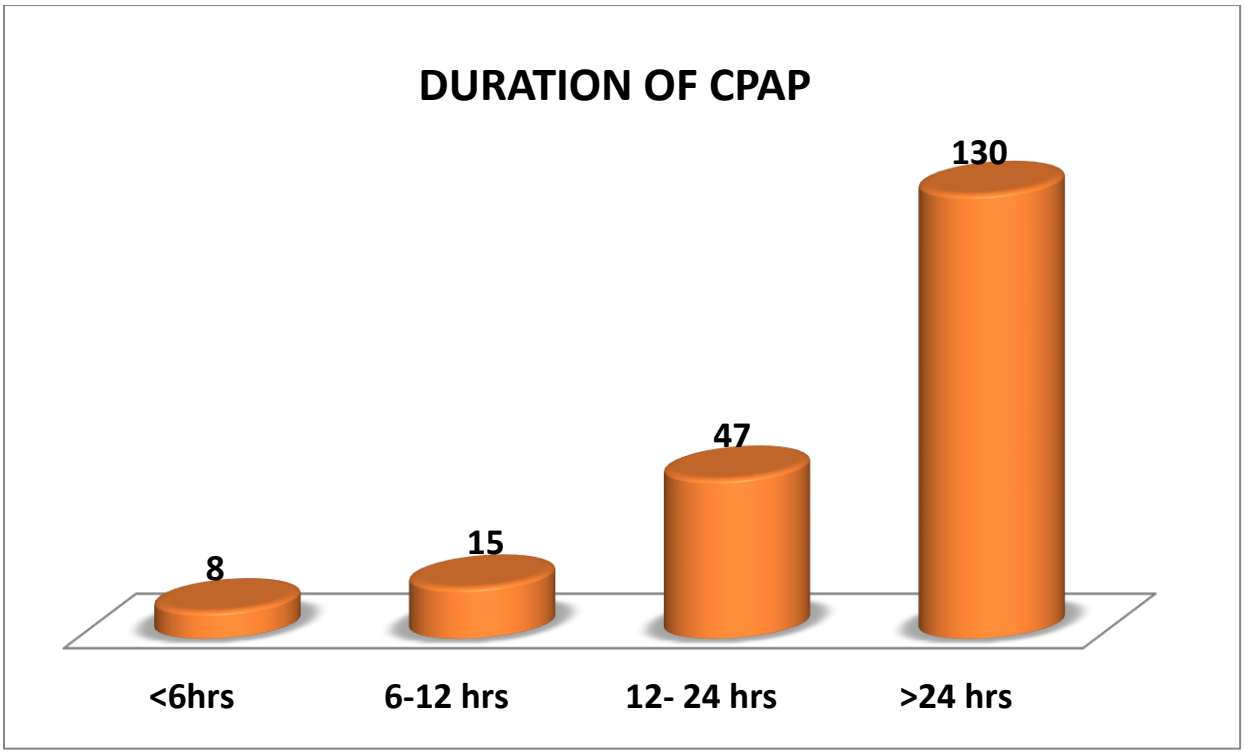


4% babies required CPAP for a duration of less than 6 hrs, 7.5% babies required for about 6-12 hrs ,23.5% babies required for 12-24 hrs and 65% babies required CPAP for a duration more than 24 hrs.

TABLE 6: DURATION OF CPAP

DURATION OF CPAP	FREQUENCY n=200	PERCENTAGE (%)
<6HRS	8	4.0
6-12 HRS	15	7.5
12- 24 HRS	47	23.5
>24 HRS	130	65.0
TOTAL	200	100.0

FIGURE 17:

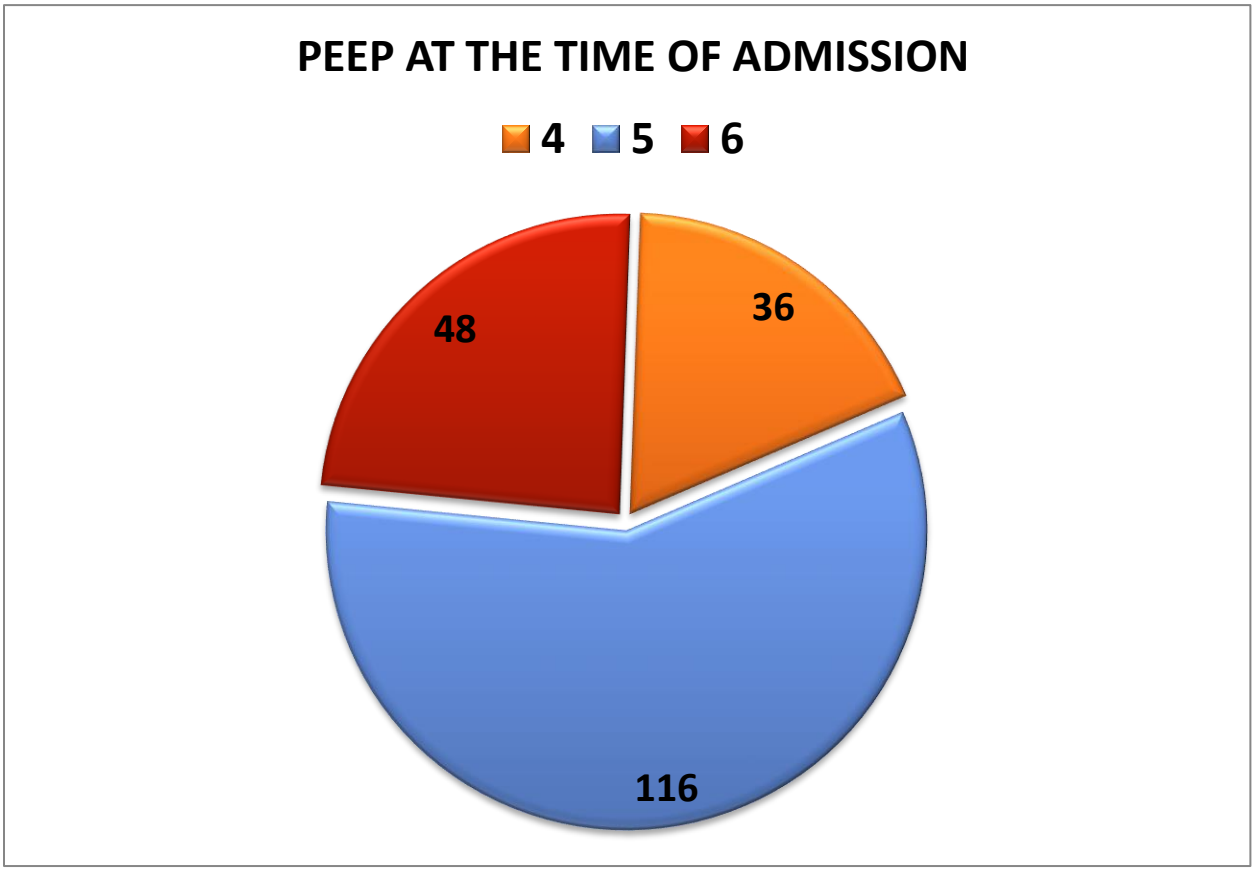


18% babies required a PEEP of 4 at the time of admission, 58% babies required a PEEP of 5 and 24% babies required PEEP of 6.

TABLE 7: PEEP AT THE TME OF ADMISSION

PEEP AT THE TIME OF ADMISSION	FREQUENCY n=200	PERCENTAGE (%)
4	36	18.0
5	116	58.0
6	48	24.0
TOTAL	200	100.0

FIGURE 18:

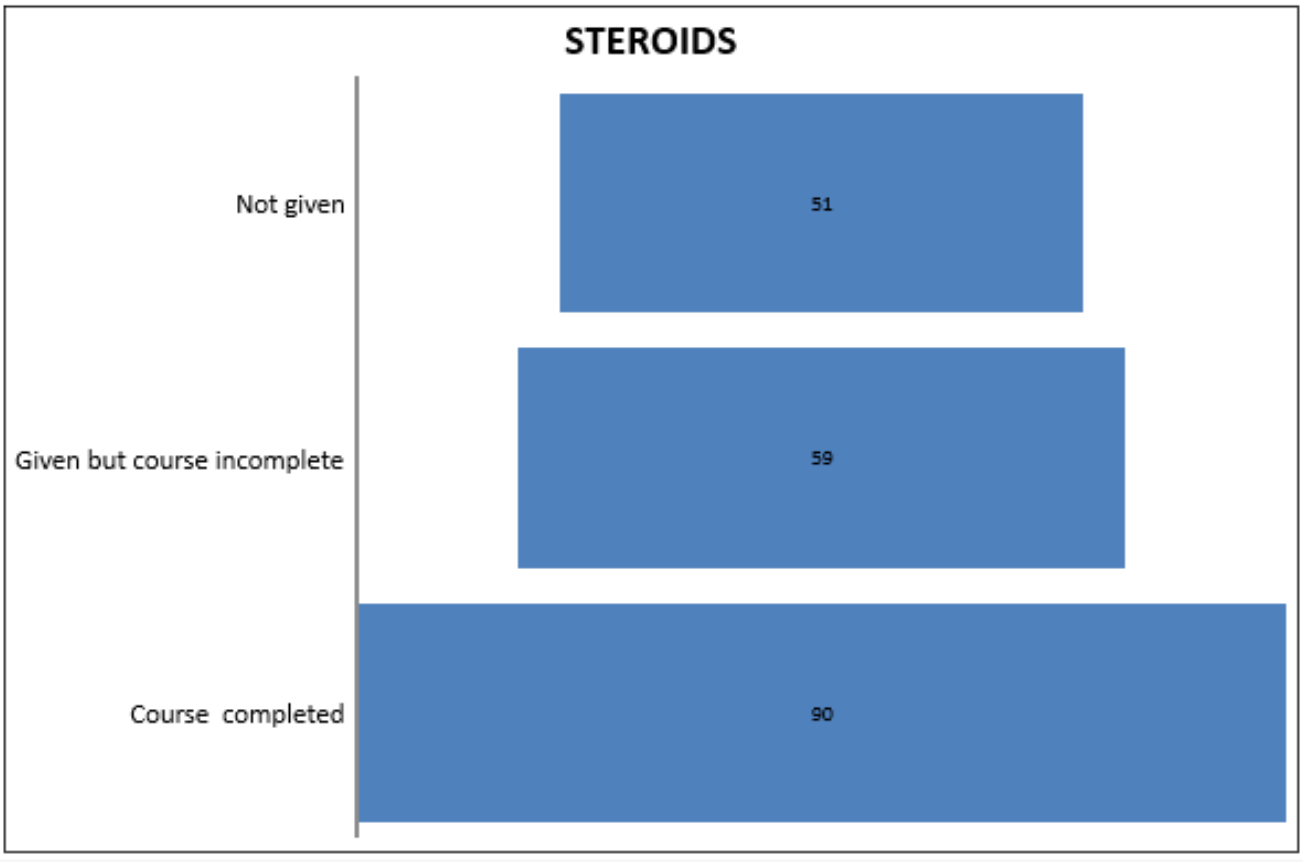


25.5% babies did not receive antenatal steroids , 29.5% babies received antenatal steroids but the course was not completed and 45% babies received complete course of steroids.

TABLE 8: ANTENATAL STEROIDS

ANTENATAL STEROIDS	FREQUENCY n=200	PERCENTAGE (%)
NOT GIVEN	51	25.5
GIVEN BUT COURSE INCOMPLETE	59	29.5
COURSE COMPLETED	90	45.0
TOTAL	200	100.0

FIGURE 19:

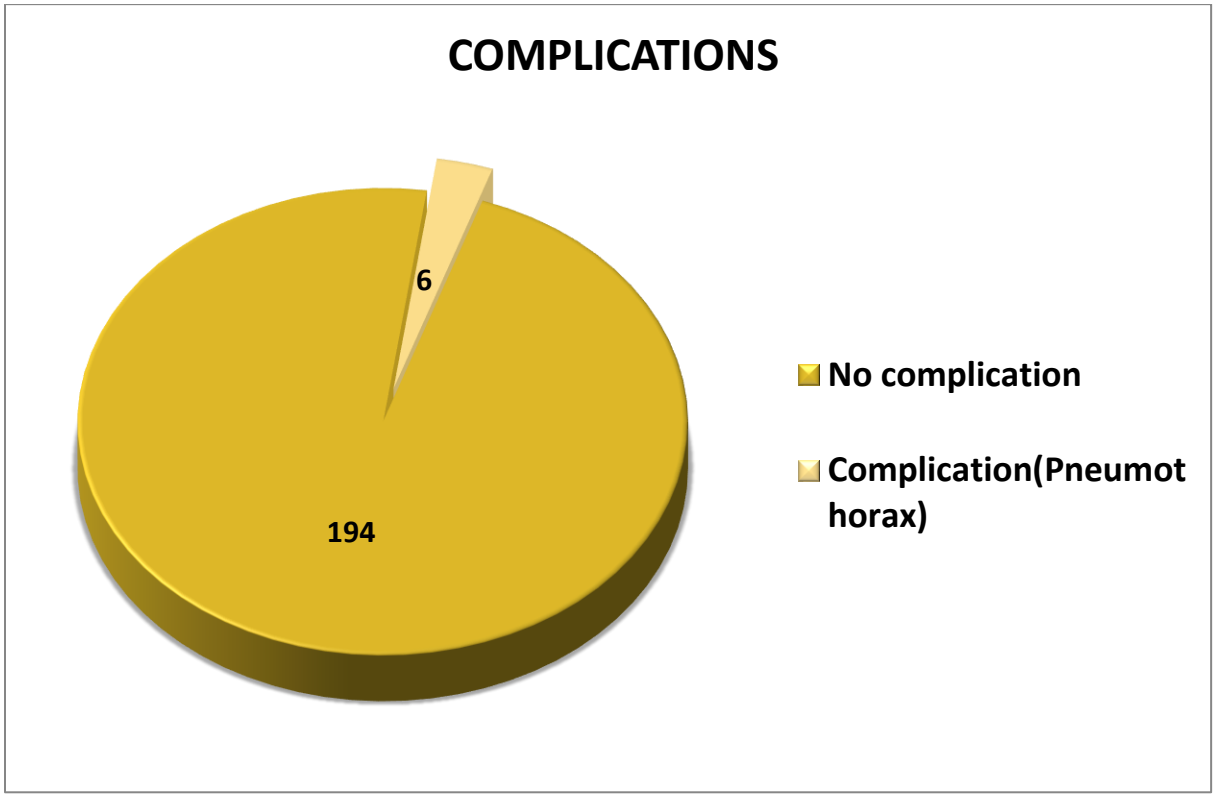


97% babies did not have any complication during the course of treatment whereas 3% babies developed complications like Pneumothorax.

TABLE 9: COMPLICATIONS

COMPLICATION	FREQUENCY n=200	PERCENTAGE (%)
NO COMPLICATION	194	97.0
COMPLICATION(PNEUMOTHORAX)	6	3.0
TOTAL	200	100.0

FIGURE 20:

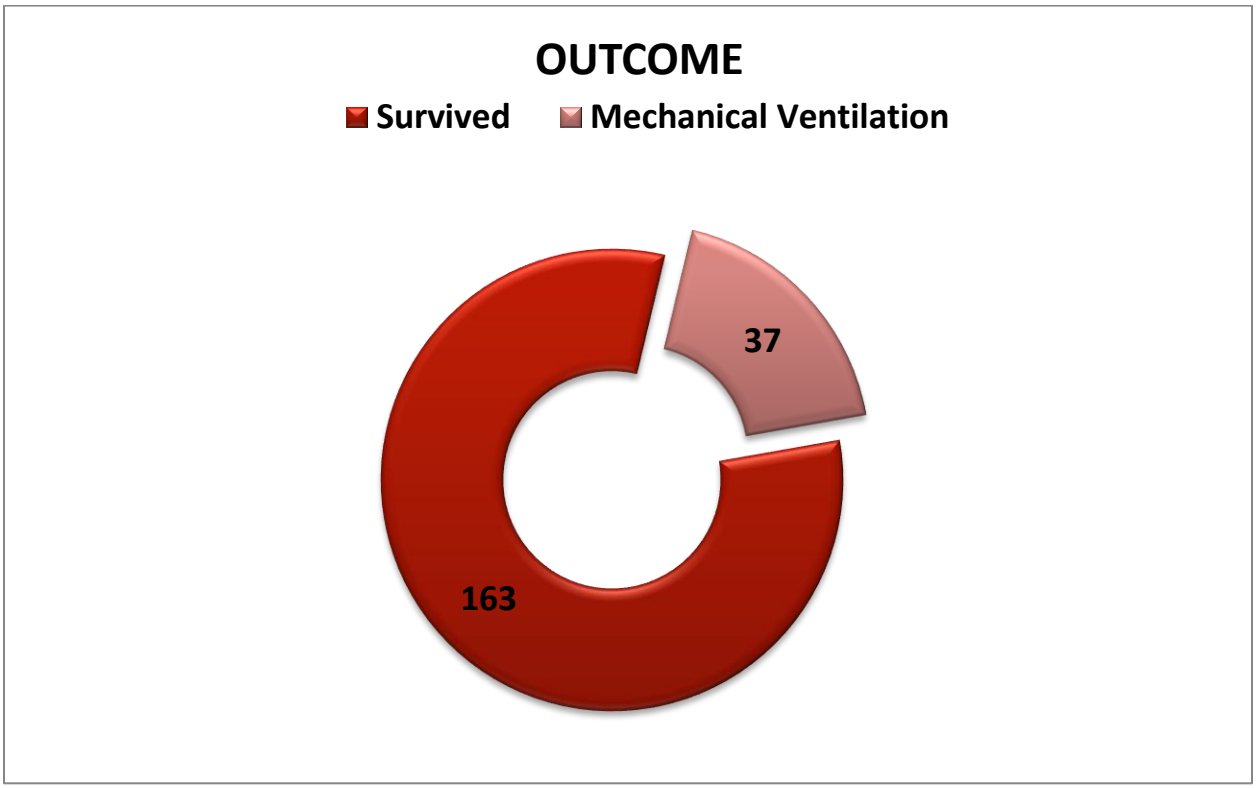


Out of the 200 babies 81.5% babies showed improvement on usage of CPAP and were weaned from CPAP whereas 18.5% babies had CPAP failure and required mechanical ventilation in due course of treatment.

TABLE 10: OUTCOME

OUTCOME	FREQUENCY n=200	PERCENTAGE (%)
SURVIVED	163	81.5
MECHANICAL VENTILATION	37	18.5
TOTAL	200	100.0

FIGURE 21:



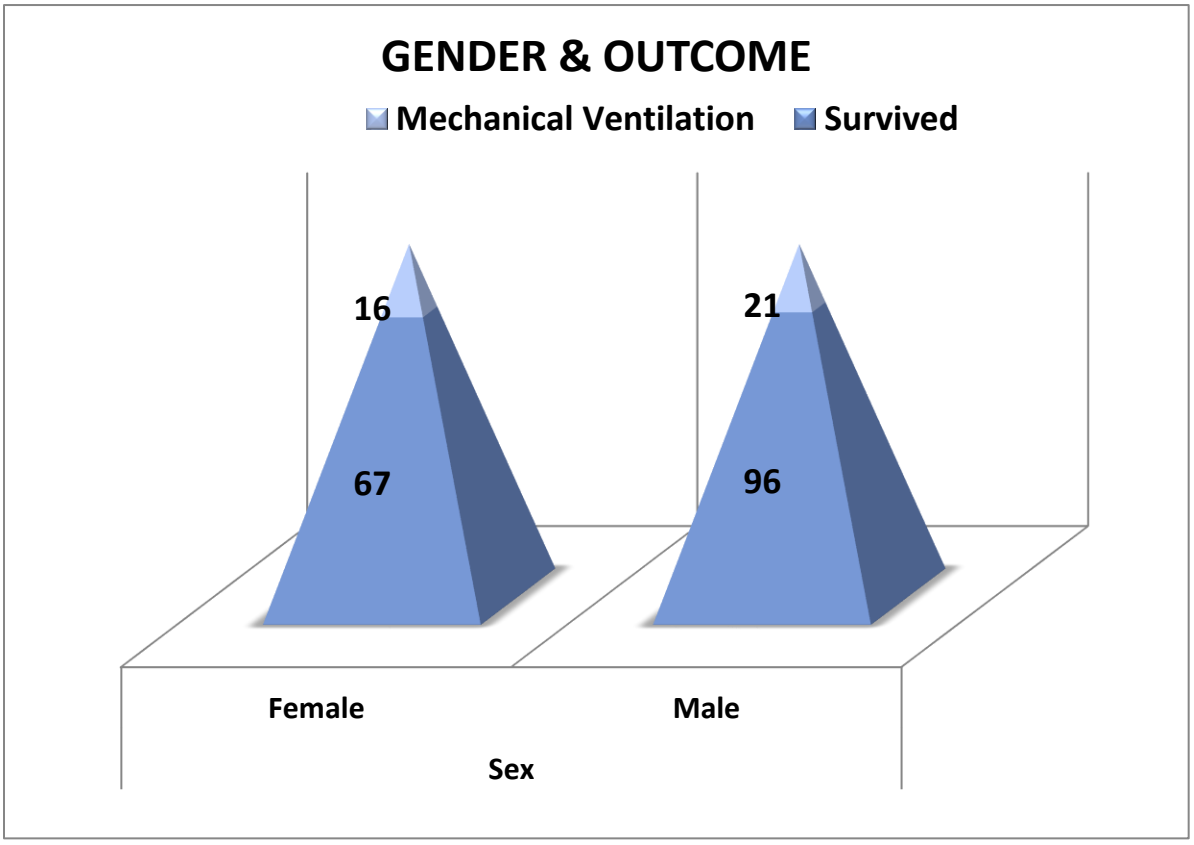
Out of 117 male babies 82.1% babies survived through CPAP and 17.9% babies required mechanical ventilation. Whereas among 83 female babies 80.7% babies survived and 19.3% babies required mechanical ventilation. There was **no significant difference** in outcome with gender.

TABLE11: GENDER AND OUTCOME

GENDER	OUTCOME		TOTAL n=200	P-VALUE¶
	SURVIVED	MECHANICAL VENTILATION		
FEMALE	67(80.7%)	16(19.3%)	83(100%)	0.812
MALE	96(82.1%)	21(17.9%)	117(100%)	
TOTAL	163(81.5%)	37(18.5%)	200(100%)	

¶Chi Square test

FIGURE 22:



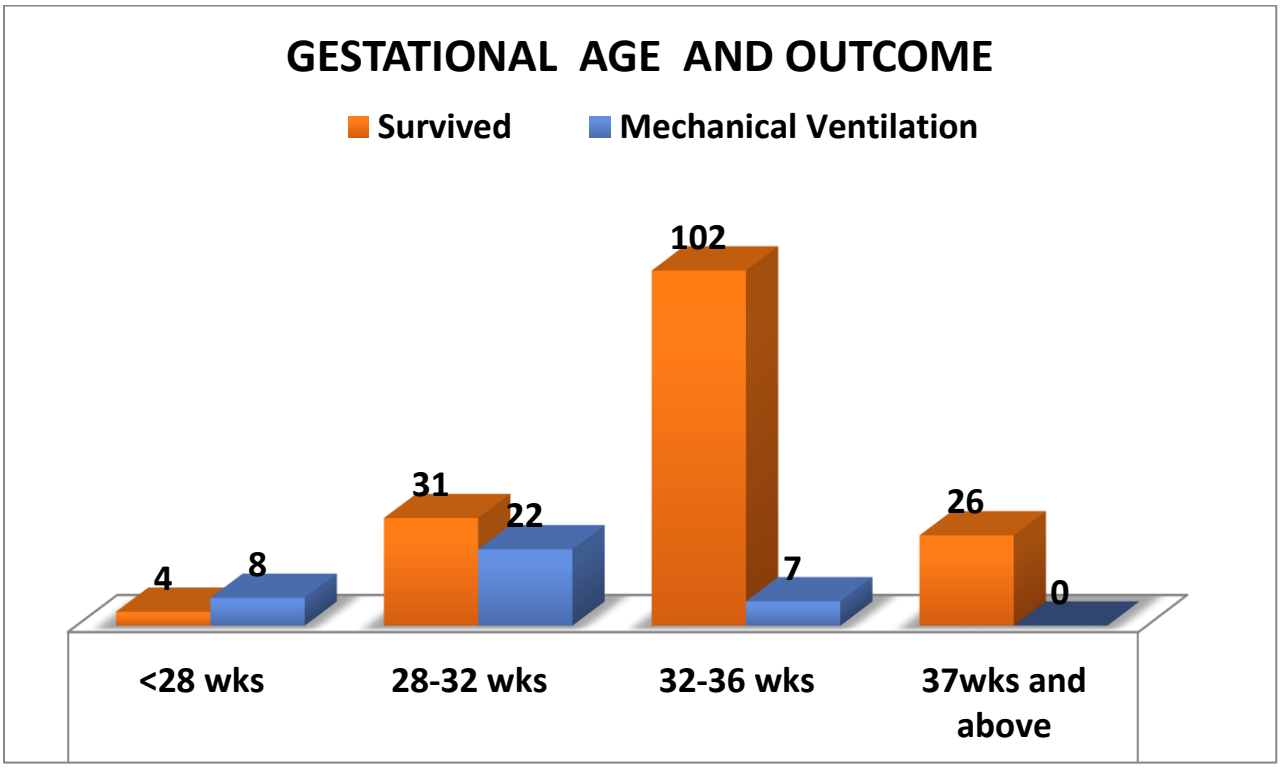
There was better outcome as the gestational age increases which indicates good lung maturity .Babies more than 36 weeks had a better survival when compared to babies between 28-32 weeks of gestational age. Neonates of 32-34 weeks had good outcome with the usage of bubble CPAP and was **statsistically significant**.

TABLE 12: GESTATIONAL AGE AND OUTCOME

GESTATIONAL AGE	OUTCOME		TOTAL n=200	P-VALUE¶
	SURVIVED	MECHANICAL VENTILATION		
<28 WKS	4(33.3%)	8(66.7%)	12(100%)	<0.001
28-32 WKS	31(58.5%)	22(41.5%)	53(100%)	
32-36 WKS	102(93.6%)	7(6.4%)	109(100%)	
37WKS AND ABOVE	26(100%)	0(0%)	26(100%)	
TOTAL	163(81.5%)	37(18.5%)	200(100%)	

¶Chi Square test

FIGURE 23:



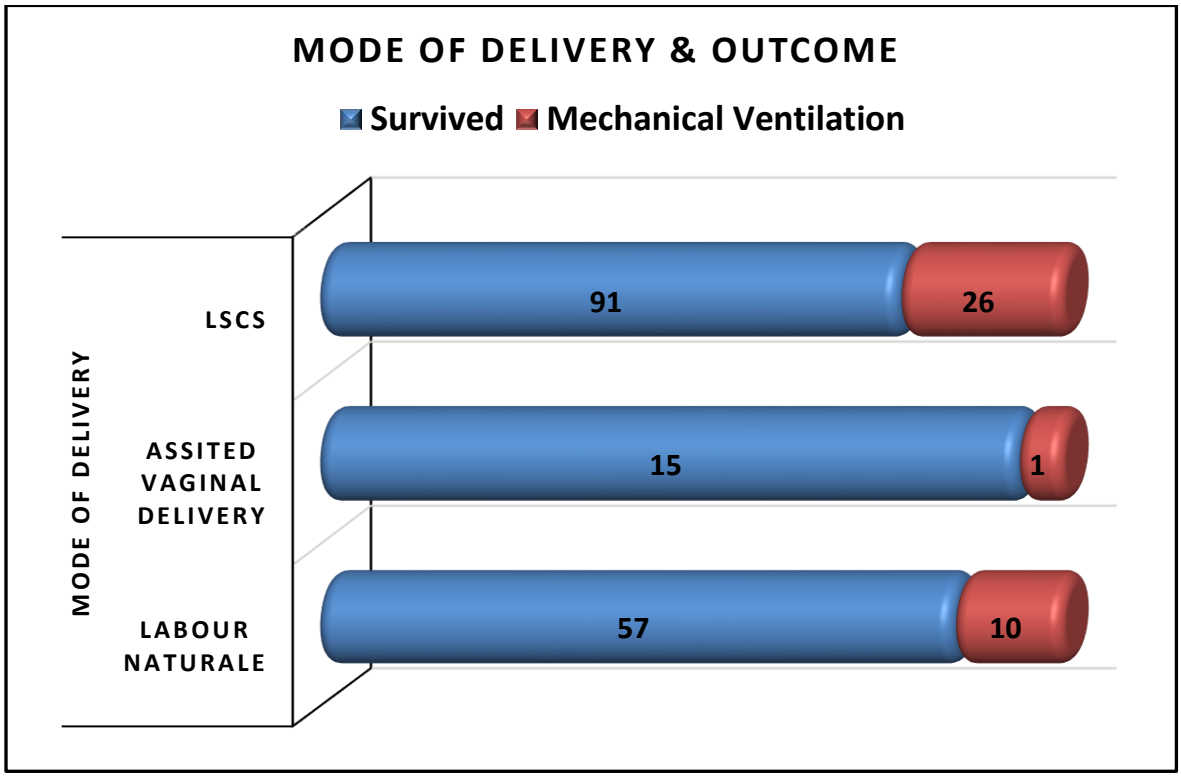
85.1% of the neonates delivered by labor naturale survived using CPAP, 93.8% of babies delivered by assisted vaginal delivery showed good outcome whereas 77.8% of LSCS deliveries survived using CPAP. Survival was better in labor naturale and assisted vaginal deliveries.

TABLE 13: MODE OF DELIVERY AND OUTCOME

MODE OF DELIVERY	OUTCOME		TOTAL n=200	P-VALUE¶
	SURVIVED	MECHANICAL VENTILATION		
LABOUR NATURALE	57(85.1%)	10(14.9%)	67(100%)	0.198
ASSITED VAGINAL DELIVERY	15(93.8%)	1(6.3%)	16(100%)	
LSCS	91(77.8%)	26(22.2%)	117(100%)	
TOTAL	163(81.5%)	37(18.5%)	200(100%)	

¶Chi Square test

FIGURE 24:



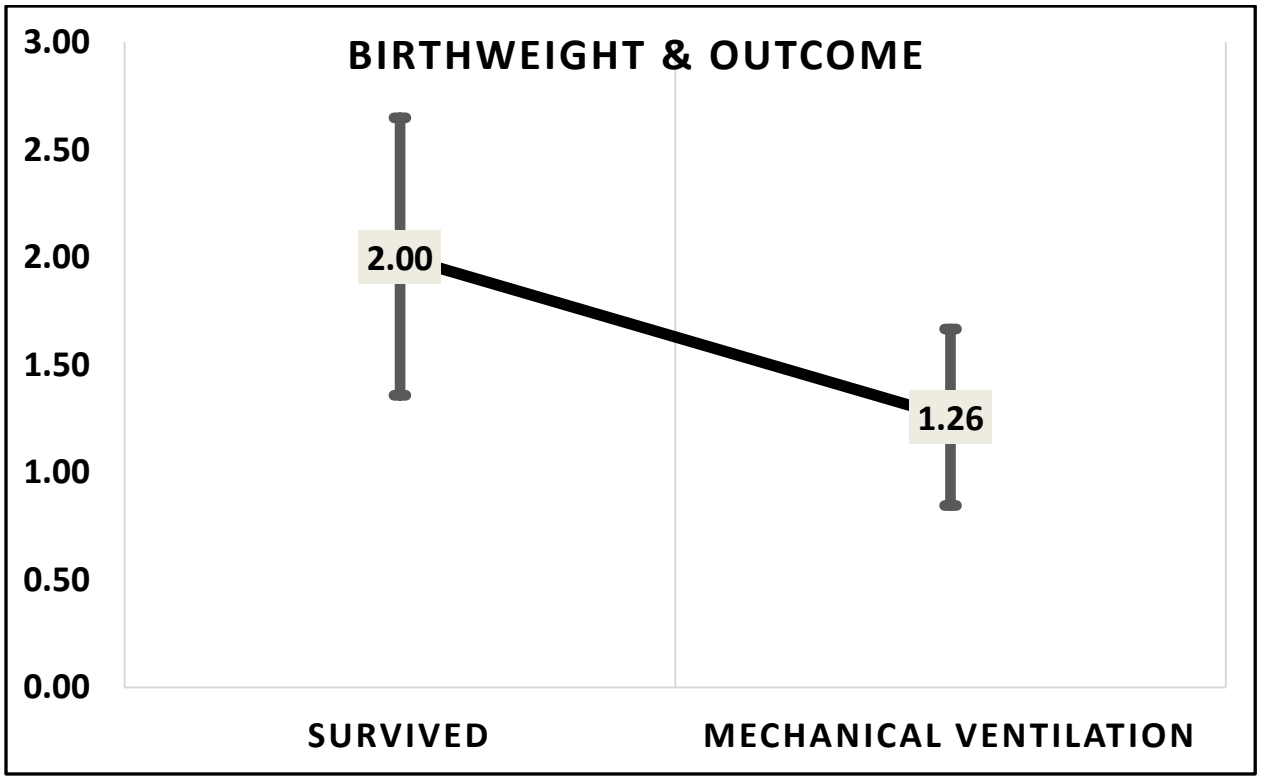
Neonates with a birth weight of more than 1.5kg showed an increase in survival whereas those less than 1 kg required mechanical ventilaton from CPAP and was **statistically significant**.

TABLE 14: BIRTH WEIGHT AND OUTCOME

OUTCOME	n=200	BIRTH WEIGHT		P-VALUE¥
		MEAN	STD. DEVIATION	
SURVIVED	163	2.00	0.64	<0.001
MECHANICAL VENTILATION	37	1.26	0.41	

¶Fisher's exact test

FIGURE 25:



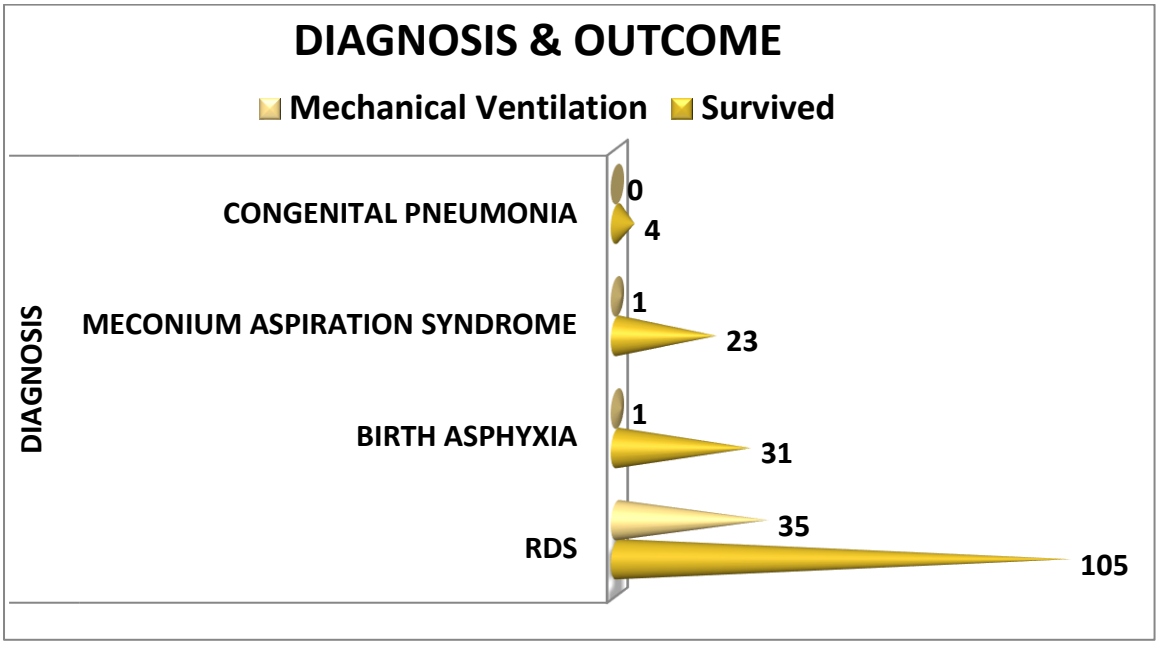
75% of Respiratory Distress Syndrome babies survived using CPAP, 96.9% of Birth Asphyxia babies showed good outcome 95.8% of babies with Meconium Aspiration Syndrome showed good survival. Also 100% of babies with Congenital Pneumonia survived through CPAP.

TABLE 15: DIAGNOSIS AND OUTCOME

DIAGNOSIS	OUTCOME		TOTAL	P-VALUE¶
	SURVIVED	MECHANICAL VENTILATION		
RESPIRATORY DISTRESS SYNDROME	105(75%)	35(25%)	140(100%)	0.001
BIRTH ASPHYXIA	31(96.9%)	1(3.1%)	32(100%)	
MECONIUM ASPIRATION SYNDROME	23(95.8%)	1(4.2%)	24(100%)	
CONGENITAL PNEUMONIA	4(100%)	0(0%)	4(100%)	
TOTAL	163(81.5%)	37(18.5%)	200(100%)	

¶Fisher's exact test

FIGURE 26:



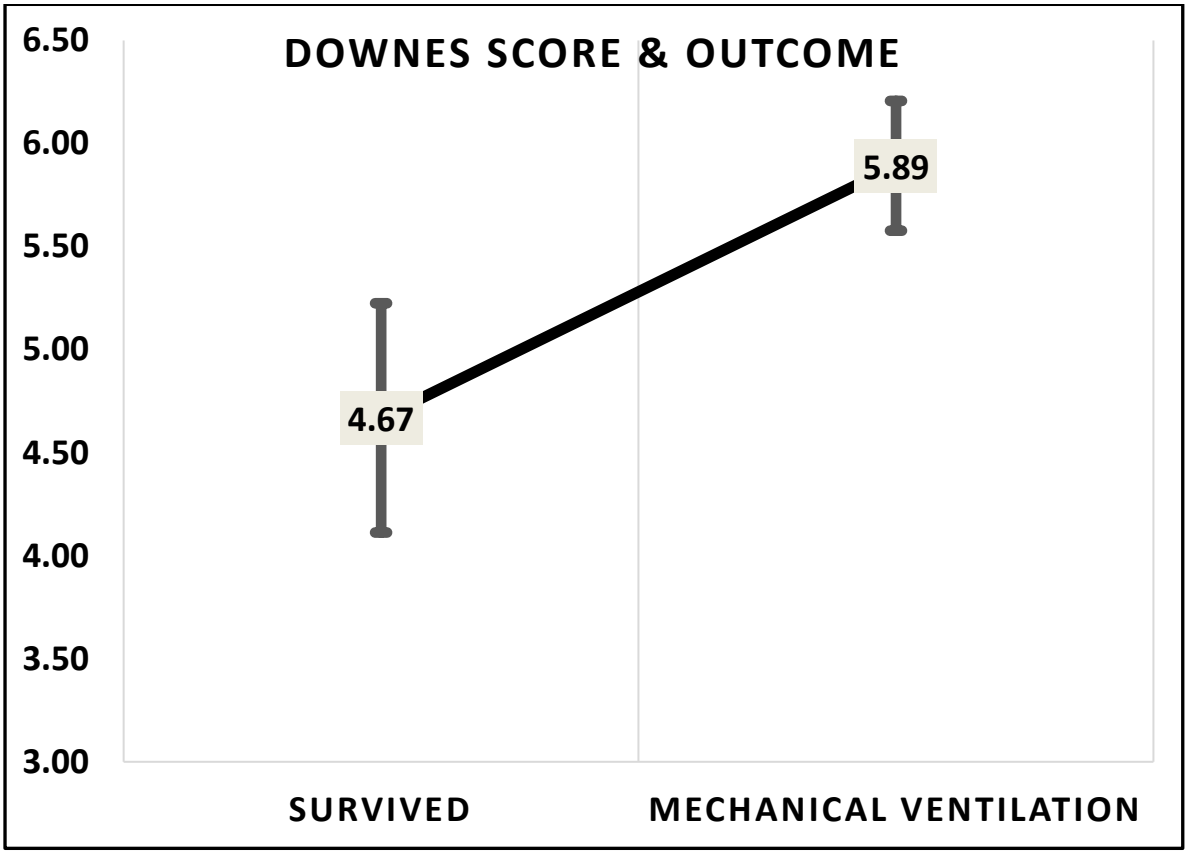
Neonates with a Downes score of 4 and 5 at the time of admission showed greater significance in survival and those with a Downes score of 6 had greater need for mechanical ventilation. This was **statistically significant.**

TABLE 16: DOWNES SCORE AND OUTCOME

OUTCOME	n=200	DOWNES SCORE		P-VALUE¥
		MEAN	STD. DEVIATION	
SURVIVED	163	4.67	0.56	<0.001
MECHANICAL VENTILATION	37	5.89	0.31	

¥Independent Sample T test

FIGURE 27:



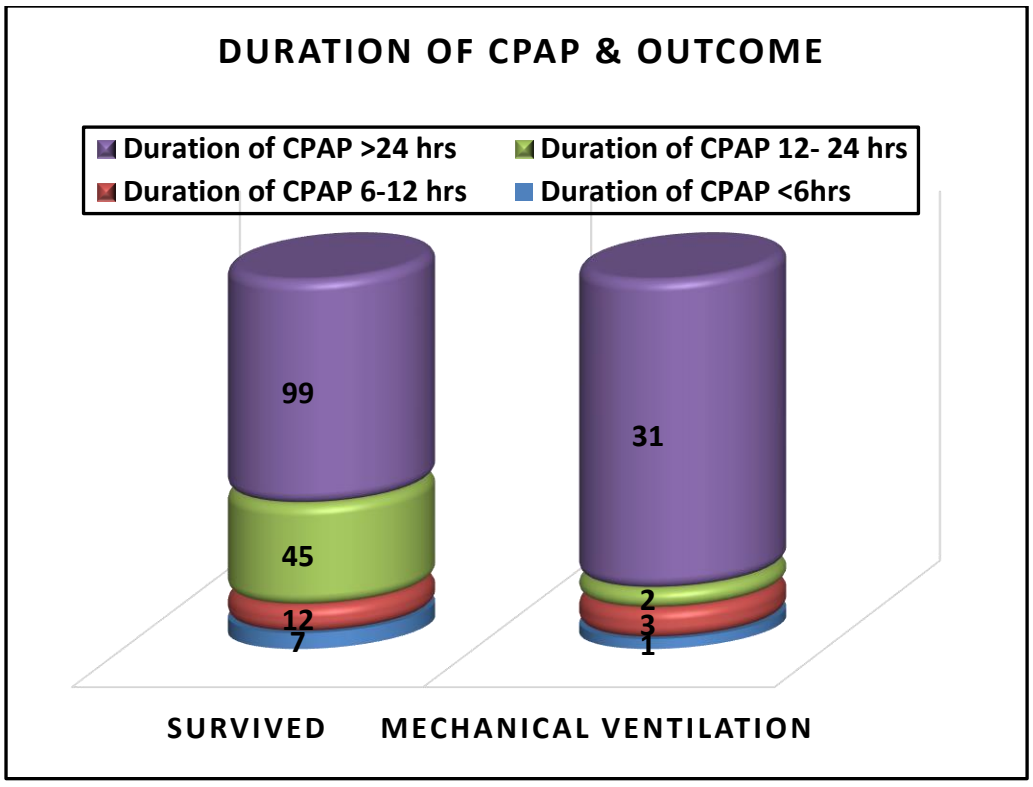
87.5% of babies survived using CPAP for less than 6 hrs, 80% survived using CPAP for 6 to 12 hrs, 95.7% requiring for 12-24 hrs showed good outcome and 99% of babies required CPAP for more than 24 hrs had better survival. There was no significant difference in the outcome with the duration of usage of CPAP.

TABLE 17: DURATION OF CPAP AND OUTCOME

DURATION OF CPAP	OUTCOME		TOTAL n=200	P-VALUE¶
	SURVIVED	MECHANICAL VENTILATION		
<6HRS	7(87.5%)	1(12.5%)	8(100%)	0.012
6-12 HRS	12(80%)	3(20%)	15(100%)	
12- 24 HRS	45(95.7%)	2(4.3%)	47(100%)	
>24 HRS	99(76.2%)	31(23.8%)	130(100%)	
TOTAL	163(81.5%)	37(18.5%)	200(100%)	

¶Fisher's exact test

FIGURE 28:



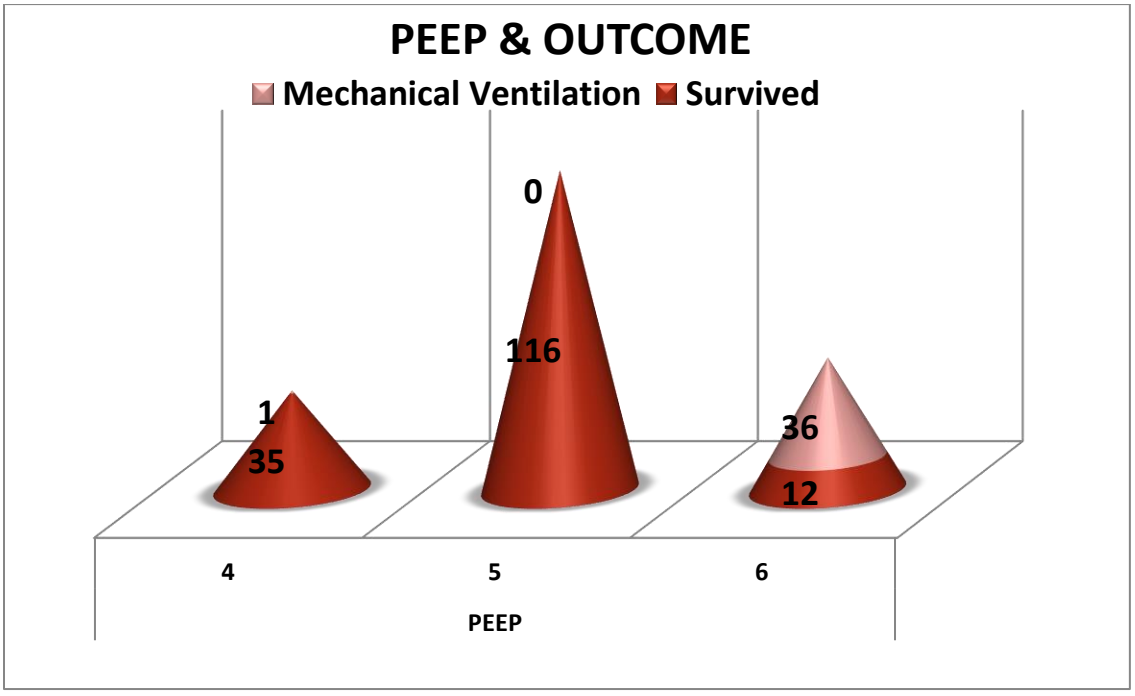
97.2% of babies requiring a PEEP of 4 at the time of admission showed good survival whereas 100% of babies survived who required a PEEP of 5.Only 25% of babies who required a PEEP of 6 survived using CPAP. There was an increase in outcome among those who required a PEEP of 4 and 5 using CPAP only and was **statistically significant**.

TABLE 18: PEEP AND OUTCOME

PEEP	OUTCOME		TOTAL n=200	P-VALUE¶
	SURVIVED	MECHANICAL VENTILATION		
4	35(97.2%)	1(2.8%)	36(100%)	<0.001
5	116(100%)	0(0%)	116(100%)	
6	12(25%)	36(75%)	48(100%)	
TOTAL	163(81.5%)	37(18.5%)	200(100%)	

¶Chi Square test

FIGURE 29:



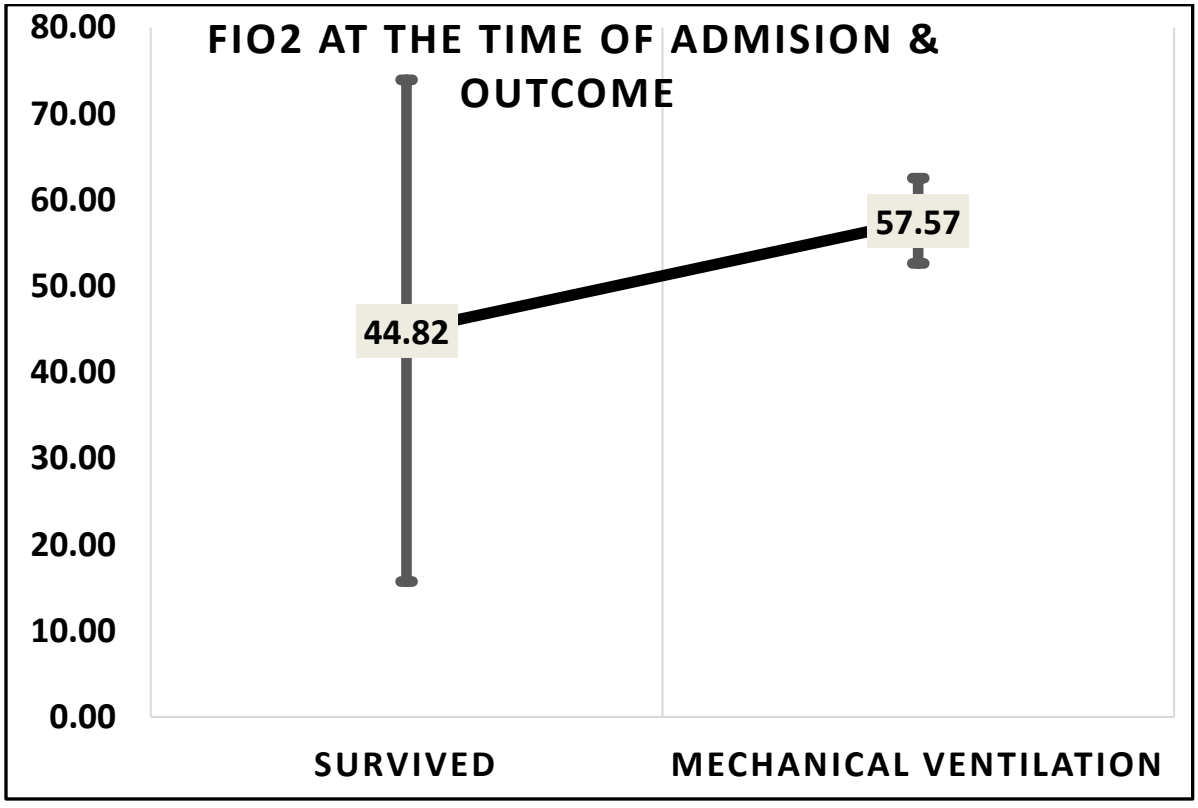
There was a significant increase in survival rate among infants who required Fio2 of 40% and 50%. At the time of admission .As the Fio2 requirement went higher than 60% the need for mechanical ventilation also increased. This was **statistically significant.**

TABLE 19: FiO2 AND OUTCOME

OUTCOME	n=200	FIO2 AT THE TIME OF ADMISSION		P-VALUE¥
		MEAN	STD. DEVIATION	
SURVIVED	163	44.82	29.11	<0.001
MECHANICAL VENTILATION	37	57.57	4.95	

¥Independent Sample T test

FIGURE 30:



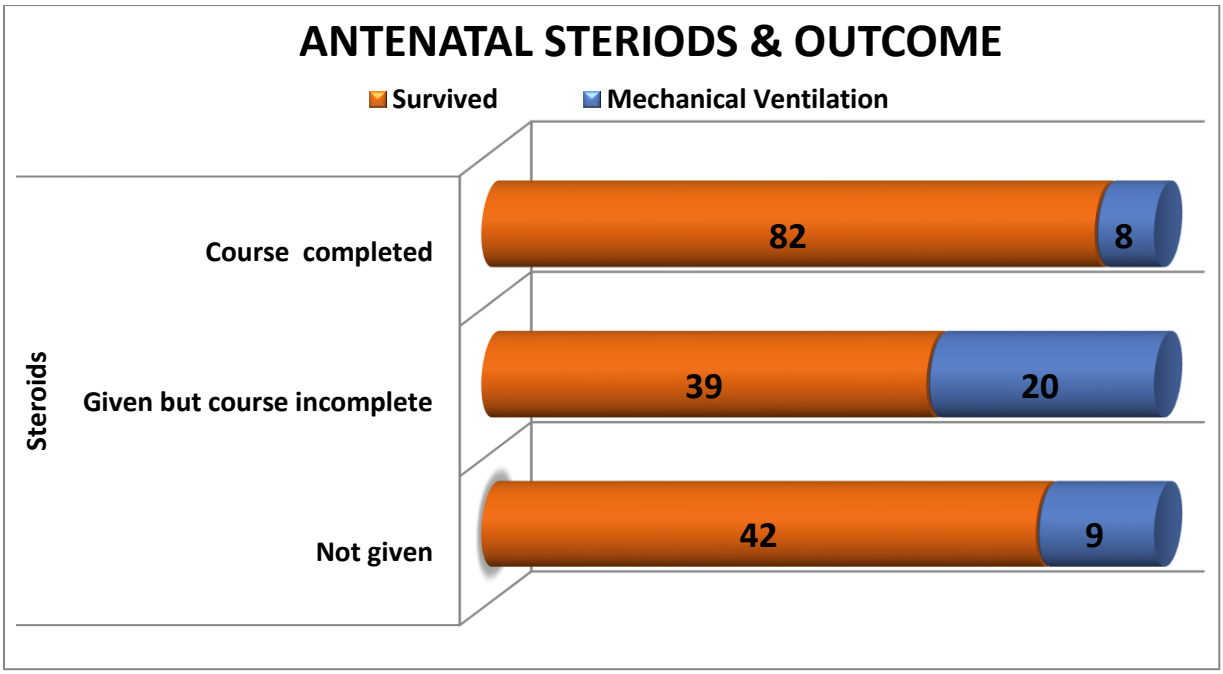
Survival was significantly higher in neonates who received a complete course of Antenatal steroids and the **association was statistically significant**. It was better in those who received incomplete course whereas those who did not receive antenatal steroids had increased risk of CPAP failure and need for mechanical ventilation.

TABLE 20: ANTENATAL STEROIDS AND OUTCOME

ANTENATAL STEROIDS	OUTCOME		TOTAL	P-VALUE¶
	SURVIVED	MECHANICAL VENTILATION		
NOT GIVEN	42(82.4%)	9(17.6%)	51(100%)	0.001
GIVEN BUT COURSE INCOMPLETE	39(66.1%)	20(33.9%)	59(100%)	
COURSE COMPLETED	82(91.1%)	8(8.9%)	90(100%)	
TOTAL	163(81.5%)	37(18.5%)	200(100%)	

¶Chi Square test

FIGURE 31:

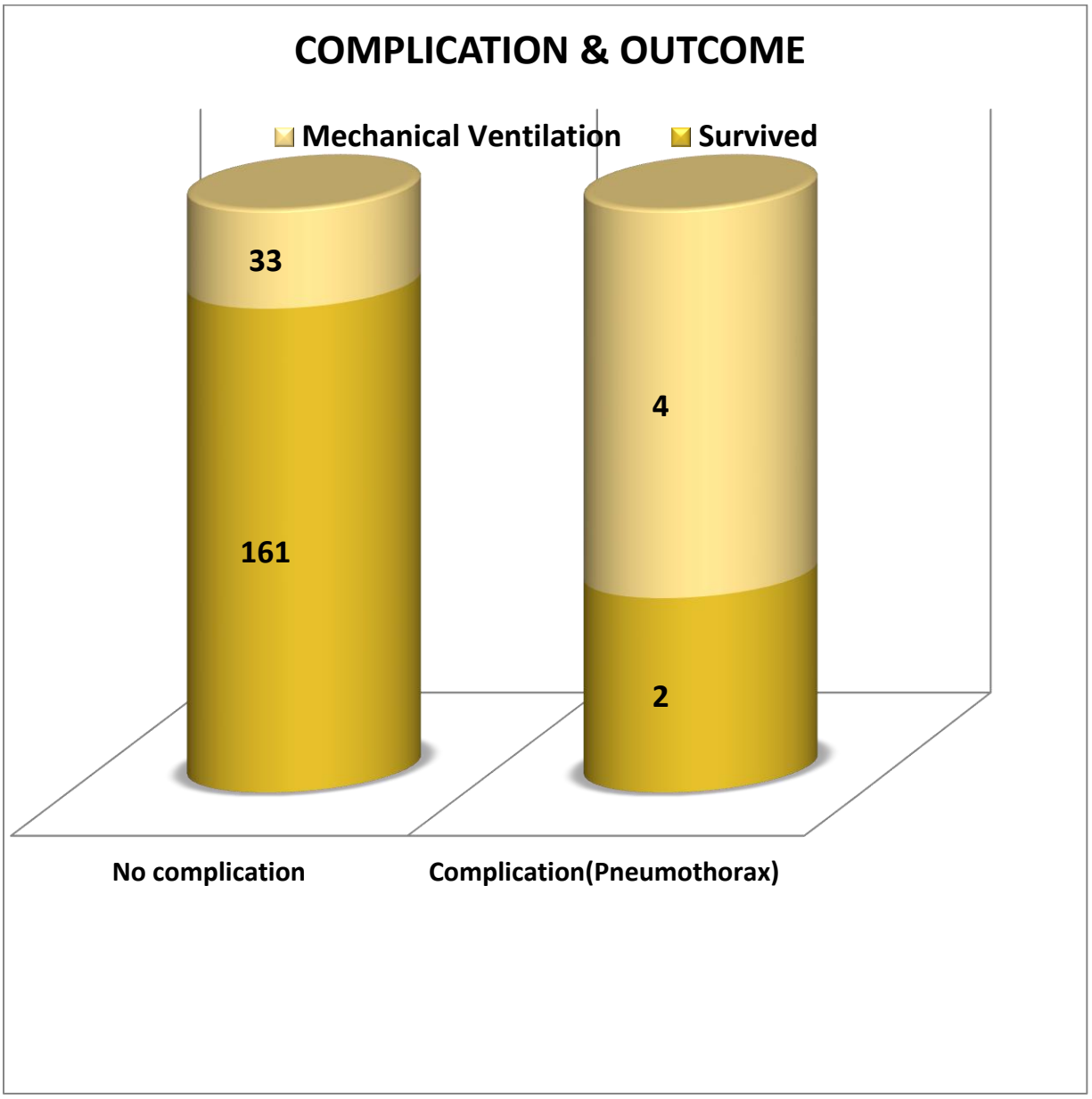


83% babies without any complications survived with CPAP while 17% babies required mechanical ventilation. Among those neonates who developed complications like pneumothorax 33.3% babies survived while 66.7% babies required mechanical ventilation.

TABLE 21: COMPLICATIONS AND OUTCOME

COMPLICATION	OUTCOME		TOTAL n=200	P-VALUE¶
	SURVIVED	MECHANICAL VENTILATION		
NO COMPLICATION	161(83%)	33(17%)	194(100%)	0.011
COMPLICATION (PNEUMOTHORAX)	2(33.3%)	4(66.7%)	6(100%)	
TOTAL	163(81.5%)	37(18.5%)	200(100%)	

FIGURE 32:


COMPLICATION & OUTCOME
Mechanical Ventilation
Survived
33
161
4
2
No complication
Complication(Pneumothorax)

DISCUSSION

DISCUSSION:

CPAP is an effective and user friendly device to rescue babies who have respiratory distress due to various causes. Comparatively BUBBLE CPAP is easy to assemble and does not require much of training for execution.

In this study 200 babies with respiratory distress were analyzed for the outcome of CPAP. Various causes of respiratory distress were diagnosed including Respiratory Distress Syndrome, Meconium Aspiration Syndrome, Birth Asphyxia and Congenital Pneumonia.

MATURITY OF THE NEONATES:

Both Term and Preterm babies were included in the study. Neonates between gestational age of 32-34 weeks were very much benefitted with CPAP. There was no significant difference in outcome with the gender of the babies. Babies with birth weight of 1.5 kg and more had a better outcome with the usage of CPAP. Neonates weighing leass than 1 kg either required prophylactic intubation or went in for CPAP FAILURE and required mechanical ventilation. In this study 4 babies weighing less than 1 kg survived by using bubble CPAP. Neonates delivered by labor naturale and assisted vaginal delivery had a better outcome when compared to those delivered by LSCS.

A study on CPAP in preterm neonates : An update on current evidence and implications for developing countries by Neeraj Gupta,Shiv Sajan Saini , Srinivas Murki

Praveen kumar[59] showed that CPAP had a good outcome on babies of more than 32 weeks gestational age and birth weight of more than 1000grams.

DOWNES SCORE

Various scores are available for assessing the respiratory distress in newborn. Commonly used scores are Downes Score and Silverman Anderson Score(predominantly used in preterm infants.) In this study Downes score was used to analyze severity.

A score of 3-6 was considered as an indication for CPAP while a score of more than 7 was taken as a sign of Impending Respiratory Failure requiring Mechanical Ventilation. Most of the babies with a score of 4 and 5 had a significant outcome with CPAP.

A study on Downes score for assessment of respiratory distress in oreterm newborn by Shashidhar A,Suman Rao PN, Joe Jose showed that inter rater variability was better in Downes score and can be widely used for respiratory distress assessment[60].

PEEP AND FIO2 REQUIREMENT:

Neonates who required a PEEP of 4 and 5 survived well with the usage of CPAP. Those whose required a PEEP of 6 required a longer duration of CPAP. Neonates with Fio2 requirement of 40% and 50% had a good outcome. Infants with 60% Fio2 requirement mostly required mechanical ventilation.

A prospective multicentre study by Ewa Gulczynska on FiO2 as a predictor of CPAP failure showed that, increased FiO2 requirement can used to predict the need for mechanical ventilation[61].

DURATION:

Duration of CPAP was highly determined by the maturity of the baby, birth weight, and the course of Antenatal steroids. Late Preterm and Term babies required CPAP for a duration of less than 24 hrs and survived well. Out of 130 babies who required CPAP for more than 24 hours 76.2% babies survived well while 23.8% babies went in for CPAP FAILURE.

A study about Duration of continuous positive airway pressure in premature infants byNicolas Bamat, Erik A. Jensen, and Haresh Kirpalani also showed that neonates with lesser gestational age required longer duration of CPAP[62].

ANTENATAL STEROIDS:

Steroids played a major role in the lung maturity of the neonates that reflected as the improvement of respiratory distress. Neonates who received a full course of antenatal steroids showed a drastic outcome with CPAP. Those who received incomplete course of steroid also showed a better survival. So even a single dose of steroid was found to be very much useful in the neonatal outcome. Not receiving even a single dose of steroid played a major role in the requirement of mechanical ventilation.

In a study of Outcome of premature babies with RDS using bubble CPAP by Vivek Arora, Sandip G Gediya, Rupali Jain[63], it showed 30.5% of CPAP failure in babies who had not been exposed or who had been partially exposed to Antenatal Steroids. In this study 81.5% of babies who received complete course of steroids showed good outcome and 17.6% of babies who did not receive antenatal steroids had CPAP failure.

COMPLICATIONS:

Prolonged usage of CPAP did have few complications like nasal trauma and pressure injuries. These can be avoided by proper nursing care and monitoring. One of the major complications was Pneumothorax. Prolonged use of CPAP and application of higher pressure levels led to air leak. This can also be prevented by appropriate monitoring and and diagnosis.

In a prospective study of Safety and effectiveness of bubble CPAP in preterm neonates with respiratory distress by S.S. Mathai, Surg Cmde, VSM,[a] A. Rajeev, Surg ,and K.M. Adhikari, Surg Capt, 2% of babies developed pneumothorax whereas in this study 3% of babies developed pneumothorax[64] .

CONCLUSION

CONCLUSION:

From this study it is concluded that

- CPAP is one of the best methods of treatment in neonates with respiratory distress.
- It is highly beneficial among preterm neonates especially less than 34 weeks who were the major victims for lung immaturity.
- Neonates diagnosed to have Respiratory Distress Syndrome recovered more with usage of non invasive ventilation like Bubble CPAP.
- This does not require trained personnel for setting up and thus can be implemented by staff nurse in the NICU.
- Downes score can be used to rapidly assess the severity of respiratory distress and also can be used to monitor the improvement during CPAP treatment.
- Antenatal steroids played a major role in the outcome of preterm babies with immature lung function and thereby the outcome with CPAP.
- Complications were very minimal with CPAP and can be easily avoided with proper nursing care and monitoring.

RECOMMENDATION

RECOMMENDATION:

CPAP thus found to be a great life saving equipment with ease of usage with minimal training can be implemented in Primary and Secondary Care Centers. This will highly improve the overall neonatal outcome and will also help in recruiting more alveoli during transit time to a tertiary care center. This will greatly improve the Neonatal Mortality and Morbidity.

Delivery Room CPAP can also be installed in labor wards and operation theatres which will help in early rescue of the neonates born with respiratory distress and will avoid alveolar collapse during transit to NICU.

LIMITATION

LIMITATIONS:

- Sample size was smaller in this study.
- Usage of Surfactant in the babies and its effect on recovery along with CPAP was not considered.
- Extra mural babies were not included in he study.

BIBLIOGRAPHY

1. Costello AML.Singh.recent developments for neonatal health in developing nations.eminars neonatal 1999;4(3):131-139.

2. Paul VK .Newborn care in India. A promising beginning, but a long way to go. Seminars neonatal 1999;4(3):141-149.

3. National Family Health Survey .India 2019-2020. International Institute for population Sciences, Mumbai,India,.

4. Singh M, Deorari AK, Paul VK, Murli MV, Mathur M. Primary causes of neonatal deaths in a tertiary care hospital in Delhi. An autopsy study of 33 cases. Pediatrics 1990;10:1517.

5. Satyanarayana .L.Indrayan A . measures of mortality and morbidity in children. Indian paediatrics2000. 37 (17):515-521.

6. Hijalmarson O. Epidemiology and classification of acute neonatal respiratory disorders. A prospective study. Acta Pediatr Scand 1981;70:733-83.

7. Singh M, Deoerari AK, Paul VK. Three years experience with neonatal ventilation from a tertiary care hospital in Delhi. Indian Pediatr 1993;30:;783-9.

8. Singh M, Deorari AK, Khajuria RC, Paul VK. A four year study on neonatal morbidity in a New Delhi hospital. Indian Med Res 1991;94(B):186-92.

9. West JB. Respiratory Physiology: The Essentials. Baltimore, MD: Williams &Wilkins; 2012

10. Wilmott RW, Boat TF, Bush A, Chernick V, Deterding RR. Kendig and Chernick's Disorders of the Respiratory Tract in Children. Philadelphia, PA: Elsevier Saunders; 2012

11. MagderS. Bench-to-bedside review: ventilatory abnormalities in sepsis. Crit Care.

2009;13(1):202.

12. Diseases. 3rd ed. Newton, PA: Handbooks in Health Care Co.; 2003Weisman LE,

Hansen TN. Contemporary Diagnosis and Management of Neonatal Respiratory diseases

13. Bancalari E, Polin RA. The Newborn Lung: Neonatology Questions and Controversies. Philadelphia, PA: Saunders Elsevier; 2008

14. Bhandari A, McGrath-Morrow S. Long-term pulmonary outcomes of patients with bronchopulmonary dysplasia. Semin Perinatol. 2013;37(2):132–137

15. Elias N, O'Brodovich H. Clearance of fluid from airspaces of newborns and infants. Neoreviews. 2006;7:e88

16. Helve O, Pitkänen OM, Andersson S, O'Brodovich H, Kirjavainen T, Otulakowski G. Low expression of human epithelial sodium channel in airway epithelium of preterm infants with respiratory distress. Pediatrics. 2004;113(5):1267–1272.

17. Carlo WA, McDonald SA, Fanaroff AA, et al. ; Eunice Kennedy Shriver National Institute of Child Health and Human Development Neonatal Research Network. Association of antenatal corticosteroids with mortality and neurodevelopmental outcomes among infants born at 22 to 25 weeks' gestation. JAMA.
2011;306(21):2348–2358.

18. Hayes EJ, Paul DA, Stahl GE, et al. Effect of antenatal corticosteroids on survival for neonates born at 23 weeks of gestation. Obstet Gynecol. 2008;111(4):921–926.

19. Abbasi S, Oxford C, Gerdes J, Sehdev H, Ludmir J. Antenatal corticosteroids prior to 24 weeks' gestation and neonatal outcome of extremely low birth weight infants. Am J Perinatol. 2010;27(1):61–66

20. Upadhyay A. Deorari AK . Continuous positive airway pressure – A gentler approach to ventilation. Indian Paediatric 2004;41(5); 459-469

21. Van Marter LJ, Allred EN, Pagano M, Sanocka U, Parad R, Moore M, et al. Do clinical markers of barotrauma and oxygen toxicity explain interhospital variation in rates of chronic lung disease? The Neonatology.Committee for the Developmental Network. Pediatrics 2000; 105: 1194- 1201.

22. Garg.P.Krishak R.Shukla DK. NICU in a community level hospital. Indian Paediatrics 2005;72; 27-30.

23. Bose A . Sinha S. Choudhary M. Aruldas K. Moses PD. Joseph A. Experiances of neonatal care in a secondary level hospital. Indian Paediatrics 1999;35 (6) ; 803-807.

24. 24.Gregory GA, Kitterman JA, Phibbs RA,Tooly WH,Treatment of idiopathic resdpiratory syndrome with continuous positive pressure. N Engl J Med 1971;284 ,;1333-1340

25. Richardson CP, Jung AL. Effects of continuous positive airway pressure on pulmonary function and blood gases of infants with respiratory distress syndrome. Pediatr Res 1978; 12: 771-774.

26. Lemyre B, Davis PG, De Paoli AG. Nasal intermittent positive pressure ventilation (NIPPV) versus nasal continuous positive airway pressure (NCPAP) for apnea of prematurity. Cochrane Database. Syst Rev 2002;

27. Halliday HL. Controversies: synthetic or natural surfactant. The case for natural surfactant. J Perinatal Medicine 1996; 24: 417-426.

28. Muscedere JG, Mullen JB, Gan K, Slutsky AS. Tidal ventilation at low airway pressures can augment lung injury. Am J Respir Crit Care Med 1994; 149: 1327-1334.

29. Muller N, Gulston G, Cade D, Whitton J, Froese AB, Bryan MH, et al.Diaphragmatic muscle fatigue in the newborn. J Appl Physiol 1979; 46: 688-695.

30. Pieper CH, Smith J, Maree D, Pohl FC. Is nCPAP of value in extreme preterms with no access to neonatal intensive care J Trop Pediatr 2003; 49: 148-152

31. Wung JT. Respiratory management for low birth weight infants. Critical CareMed 1993;21(9 Suppl):S364–s365

32. Avery ME, Tooley WH, Keller JB, Hurd SS, Bryan MH, Cotton RB, et al. Is chronic lung disease in low birth weight infants preventable? A survey of eight centers. Pediatrics 1987; 79: 26-30.
33. Lee KS, Dunn MS, Fenwick M, Shennan AT. A comparison of underwater bubble continuous positive airway pressure with ventilator-derived continuous positive airway pressure in premature neonates ready for extubation. Biol Neonate. 1998;73(2):69–75.
34. Narendran V, Donovan EF, Hoath SB, et al. Comparison between early bubble CPAP and conventional CPAP in reducing the incidence of chronic lung disease. Pediatrics Res. 2002;51:337A.
35. Rezzonico R, Caccamo LM, Manfredini V, et al. Impact of the systematic introduction of low-cost bubble nasal CPAP in a NICU of a developing country: a prospective pre- and post-intervention study. BMC Pediatr. 2015;15:26.
36. Dewez JE, van den Broek N. Continuous positive airway pressure (CPAP) to treat respiratory distress in newborns in low- and middle-income countries. Trop Doct. 2017;47(1):19–22.
37. Jayashree M, KiranBabu HB, Singhi S, Nallasamy K. Use of nasal bubble CPAP in children with hypoxemic clinical pneumonia-report from a resource limited set-up. J Trop Pediatr. 2016;62(1):69–74.

38. Abdulkadir I, Hassan L, Abdullahi F, Purdue S, Ogala WN. Nasal bubble CPAP: one year experience in a neonatal unit of a tertiary health facility in northwestern Nigeria. Niger Postgrad Med J. 2015;22(1):21–24

39. Cummings JJ, Polin RA, The Committee on Fetus and Newborn American Academy of Pediatrics Noninvasive respiratory support. Pediatrics. 2016;137(1):169–73

40. Aly HZ. Nasal prongs continuous positive airway pressure: a simple yet powerful tool. Pediatrics 2001;108:759-61.

41. De Paoli AG, Davis PG, Faber B, Morley CJ. Devices and pressure sources for administration of nasal continuous positive airway pressure (NCPAP) in preterm neonates. Cochrane Database. Syst Rev 2002; CD002977.

42. Robertson NJ, McCarthy LS, Hamilton PA, Moss AL. Nasal deformities resulting from flow driver continuous positive airway pressure. Arch Dis Child Fetal Neonatal Ed 1996; 75: F209-F212.

43. Sreenan C, Lemke RP, Hudson-Mason A, Osiovich H. High-flow nasal cannulae in the management of apnea of prematurity: a comparison with conventional nasal continuous positive airway pressure. Pediatrics 2001;107:1081-1083.

44. .Benveniste D, Berg O, Pedersen JE. A technique for delivery of continuous positive airway pressure to the neonate. J Pediatr 1976; 88: 1015-1019.

45. Moa G, Nilsson K, Zetterstrom H, Jonsson LO. A new device for administration of nasal continuous positive airway pressure in the newborn: an experimental study. Crit Care Med 1988; 16: 1238-1242.

46. Jobe AH, Kramer BW, Moss TJ, Newnham JP, Ikegami M. Decreased indicators of lung injury with continuous positive expiratory pressure in preterm lambs. Pediatr Res 2002; 52: 387-392.

47. Kamper J, Wulff K, Larsen C, Lindequist S. Early treatment with nasal continuous positive airway pressure in very low-birth-weight infants. Acta Paediatr 1993; 82: 193-197.

48. Tanswell AK, Clubb RA, Smith BT, Boston RW. Individualised continuous distending pressure applied within 6 hours of delivery in infants with respiratory distress syndrome. Arch Dis Child 1980; 55: 33- 39.

49. Davis PG, Henderson-Smart DJ. Nasal continuous positive airways pressure immediately after extubation for preventing morbidity in preterm infants. Cochrane Database. Syst Rev 2003; CD000143.

50. Verder H, Robertson B, Greisen G, Ebbesen F, Albertsen P, Lundstrom K et al. Surfactant therapy and nasal continuous positive airway pressure for newborns with respiratory distress syndrome. Danish-Swedish Multicenter Study Group. N England Med 1994; 331: 1051-1055.

51. Ogata ES, Gregory GA, Kitterman JA, Phibbs RH, Tooley WH. Pneumothorax in the respiratory distress syndrome: incidence and effect on vital signs, blood gases, and pH. Pediatrics 1976; 58: 177-183.

52. Wong W, Fok TF, Ng PC, Chui KM, To KF. Vascular air embolism: a rare complication of nasal CPAP. J Paediatrics Child Health 1997; 33: 444- 445.

53. Efficacy and safety of CPAP in low- and middle-income countries A Thukral, MJ

Sankar, A Chandrasekaran, R Agarwal and VK Paul, Journal of Perinatology (2016)

36, S21–S28.

54. Continuous Positive Airway Pressure in Preterm Neonates: An Update of Current

Evidence and Implications for Developing Countries NEERAJ GUPTA, SHIV SAJAN SAINI, SRINIVAS MURKI, PRAVEEN KUMAR AND ASHOK DEORARI Departments of Pediatrics, #AIIMS Jodhpur; *PGIMER, Chandigarh; Fernandez Hospital Hyderabad and AIIMS, New Delhi, India.

55. Outcome of Early Cpap in the Management of Respiratory Distress Syndrome (RDS) in Premature Babies with ≤32 Weeks of Gestation, A Prospective Observational Study by R.V.Jeya Balaji,P.K.Rajiv, Vaibav K Patel, Mathew Kripail.

56. Outcome of Bubble (CPAP) Continuous Positive Airway Pressure in Neonates with Respiratory Distress and its failure factors by Sunitha Kumari Byram , Y. Sivaramakrishna, M.S. Raju.

57. A descriptive study on the use of bubble CPAP in a level 2 neonatal intensive unit in Bangalore , India by Hyalyad Sunita C Parasuramappa Gangadhar Belavadi.

58. Trends in use of neonatal CPAP: A population-based study. Christine L RobertsTim

Badgery-ParkerCharles S AlgertJennifer R Bowen.

59. A study on CPAP in preterm neonates : An update on current evidence and implications for developing countries by Neeraj Gupta,Shiv Sajan Saini , Srinivas murki,Praveen kumar.

60. Downes score versus Siverman Anderson score for assessment of respiratory distress in preterm newborns by Shashishar A, Suman Rao PN ,Joe Jose.

61. Fraction of Inspired Oxygen as a predictor of CPAP failure in preterm infants with respiratory distress syndrome :A Prspective Multicentre Study by Ewa Gulczynska et al. Neonatology. 2019.

62. Duration of continuous positive airway pressure in premature infants: Nicolas Bamat, Erik A. Jensen, and Haresh Kirpalani.

63. Outcome of premature babies with RDS using bubble CPAP Vivek Arora, Sandip G Gediya, Rupali Jain.

64. Safety and effectiveness of bubble continuous positive airway pressure in preterm neonates with respiratory distress S.S. Mathai, Surg Cmde, VSM,A. Rajeev, Surg Cdr,and K.M. Adhikari, Surg Capt.

ANNEXURE I

PROFORMA

CLINICAL PROFILE AND OUTCOME OF NASAL CPAP

Name…… Age……

Sex…….. SNCU No……..

DOB& Time: …… Place : GMKMCH / GH / PHC / Home

Mode : LN/Breech / Foreceps / LSCS (Indication) Birth Wt.

Term / Pre Term AGA / SGA /LGA Gestational Age:

Apgar 1 min : 5 min : 10 min.

MATERNAL DETAILS:

Name …… Age……..

G : P : L : A :

LMP : EDD : Blood Gp : MRO / PROM :

Antinatal Steriods : Y/ N Course completed / Not Completed
(__doses received)

Risk Factors : HT / DM/ BA/Thyroid complicating pregnancy

NEWBORN DETAILS:

DOA : Provisional Diagnosis on admission:

O / E : colour : Pink / Acro cyanosis /central cyanosis Cry and activity:

HR : > 100 / min. or < 100 / min RR : /min Resp. distress : Y/ N

SpO2 : in RA / with O2 CRT :<3 secs/ >3 secs

DOWNES SCORE ON ADMISSION:

CVS : RS : P/A : CNS :

Investigations : CXR : Others:

Treatment :

NASAL CPAP :

Date &time	FiO2 %	PEEP	Flow	SpO2	Rate	Downes score	Remarks

Date and time of application : Date and time of weaning :

Complications during CPAP :

Outcome : Recovered/ CPAP failure.

ANNEXURE II

MASTER CHART

SNO	NAME	AGE	SEX	GA	MODE OF DELIVERY	BIRTH WEIGHT	DIAGNOSIS	DOWNES SCORE	DURATION OF CPAP	PEEP	FIO2	STEROIDS	COMPLICATION	OUTCOME
1	B/o Revathy	1/365	Mch	A	A	1.2	A	5	D	B	60%	C	A	A
2	B/o Deepa	1/365	Mch	C	A	2.2	A	4	A	A	40%	B	A	A
3	B/o Nivetha	1/365	Fch	B	A	2	A	4	D	B	50%	C	A	A
4	B/o Priyadharshini	1/365	Fch	C	C	2.3	A	4	D	B	50%	C	A	A
5	B/o Anitha	1/365	Mch	C	C	2.6	B	5	D	B	50%	B	A	A
6	B/o Poongodi	1/365	Mch	D	C	2.5	C	4	B	B	40%	A	A	A
7	B/o Sathyapriya	1/365	Mch	B	C	1.4	A	5	D	C	50%	C	A	A
8	B/o Saraswathi	1/365	Mch	C	A	2.2	A	4	D	B	50%	C	B	A
9	B/o Soundarya	1/365	Fch	B	C	1	A	3	D	B	50%	C	A	A
10	B/o Memila	1/365	Fch	B	A	1.2	A	4	D	C	50%	B	A	A
11	B/o Priyadharshini	1/365	Mch	C	C	2.5	B	6	C	A	40%	C	A	A
12	B/0 Sathya A	1/365	Fch	B	A	1.6	A	4	D	B	50%	C	A	A
13	B/o Selvapriya	1/365	Fch	A	A	1.1	A	4	D	B	40%	B	A	A
14	B/o Krishnaveni	1/365	Mch	D	B	2.5	B	4	D	B	50%	A	A	A
15	B/o Nandhini	1/365	Fch	D	A	2.8	C	5	D	B	50%	A	A	A
16	B/o sandhya	1/365	Mch	D	A	2.6	B	4	D	C	50%	A	A	A
17	B/o Palaniyammal	1/365	Mch	D	C	3	B	4	C	A	40%	A	A	A
18	B/o Keerthana	1/365	Mch	B	C	1.7	A	5	D	B	40%	C	A	A
19	B/o Rajalakshmi	1/365	Mch	B	A	1.8	A	4	B	A	30%	C	A	A
20	B/0 Eswari	1/365	Fch	A	A	0.77	A	6	B	A	70%	B	A	B
21	B/o Thangam	1/365	Fch	C	A	2.3	B	4	D	C	50%	B	A	A
22	B/o Meena	1/365	Mch	A	C	1	B	6	D	C	50%	C	A	A
23	B/o Sujatha	1/365	Fch	D	C	3.5	D	4	D	B	50%	A	A	A
24	B/o Deepa	1/365	Mch	C	A	2.7	A	4	A	A	40%	B	A	A
25	B/o Gunavathi	1/365	Mch	B	A	1.1	A	6	D	C	60%	C	A	B
26	B/o Manjula	1/365	Fch	C	C	3	C	5	B	A	40%	A	A	A
27	B/o Pavithra	1/365	Mch	B	C	0.9	A	6	D	C	50%	C	A	A
28	B/o Deepa	1/365	Fch	C	C	1.3	A	6	D	C	60%	B	A	B
29	B/o Vijaya	1/365	Mch	B	C	1.2	A	5	C	B	50%	B	A	A
30	B/o Dharani	1/365	Mch	C	B	3.3	C	5	D	B	50%	A	A	A
31	B/o Andiyammal	1/365	Fch	C	A	2.5	A	4	D	A	40%	A	A	A
32	B/o Nivedha	1/365	Mch	D	C	2.9	A	4	A	A	40%	A	A	A
33	B/o Ramya	1/365	Fch	C	A	2.8	B	5	B	B	50%	B	A	A

SNO	NAME	AGE	SEX	GA	MODE OF DELIVERY	BIRTH WEIGHT	DIAGNOSIS	DOWNES SCORE	DURATION OF CPAP	PEEP	FIO2	STEROIDS	COMPLICATION	OUTCOME
34	B/o Andiyammal	1/365	Mch	C	A	2	A	5	C	B	50%	C	A	A
35	B/o Mehaboobi	1/365	Mch	C	A	2.1	A	6	D	B	50%	C	A	A
36	B/o Deepa	1/365	Fch	C	B	2.7	A	5	D	B	50%	C	A	A
37	B/o Valli	1/365	Mch	C	A	1.3	A	6	D	C	60%	B	A	B
38	B/o Rameena	1/365	Fch	B	A	1.75	A	5	D	C	60%	B	A	B
39	B/o Soundarya	1/365	Mch	C	C	1.96	B	5	D	B	40%	C	A	A
40	B/0 Valliyammal	1/365	Mch	C	A	2.7	A	4	C	A	50%	C	A	A
41	B/o Sandhya	1/365	Mch	C	C	1.9	A	5	D	B	50%	C	A	A
42	B/o Kanagalakshmi	1/365	Fch	C	A	2.4	A	4	C	B	40%	C	A	A
43	B/o Sowmya	1/365	Mch	B	C	1.2	A	6	D	C	60%	C	A	B
44	B/o Maragadham	1/365	Mch	C	A	3.2	C	4	C	B	40%	B	A	A
45	B/o Jasmine	1/365	Fch	B	C	1.3	A	5	D	B	50%	C	A	A
46	B/o Pavithra	1/365	Mch	A	C	0.9	A	5	D	C	60%	A	A	B
47	B/o Suganthi	1/365	Mch	C	A	1.5	A	5	D	B	40%	B	A	A
48	B/o Kavitha A	1/365	Fch	C	C	1.8	A	5	D	B	50%	C	A	A
49	B/o Kavitha B	1/365	Mch	C	C	2.05	A	5	D	B	40%	C	A	A
50	B/o Mahalakshmi	1/365	Mch	B	A	1.4	A	5	D	C	60%	B	A	B
51	B/o Azhagi	1/365	Mch	C	A	2.3	C	6	D	C	60%	B	A	B
52	B/o Bharathi	1/365	Fch	C	A	1.5	B	5	D	B	50%	C	A	A
53	B/o Rajeshwari	1/365	Mch	B	C	0.9	A	6	D	C	60%	B	A	B
54	B/o Pushpa	1/365	Mch	B	A	1.6	A	5	D	B	50%	C	A	A
55	B/o Ramya	1/365	Fch	B	A	1.1	A	5	D	C	60%	A	A	B
56	B/o Thenmozhi	1/365	Mch	C	A	1.4	A	5	D	B	40%	C	A	A
57	B/o Vimala	1/365	Mch	B	C	1.3	A	6	D	C	60%	A	A	B
58	B/o Krishnaveni	1/365	Fch	C	A	1.7	B	5	C	B	30%	C	A	A
59	B/o Nazeema	1/365	Mch	B	A	1.2	B	6	D	C	60%	C	A	B
60	B/o Bharathi	1/365	Mch	B	C	1.4	A	6	D	C	60%	A	A	B
61	B/o Gomathi	1/365	Fch	B	A	1.3	A	6	D	C	60%	B	A	B
62	B/o Gunavathi	1/365	Mch	B	C	1.5	A	6	D	C	60%	A	A	B
63	B/o Leelavathi	1/365	Fch	C	B	2.4	C	4	C	A	40%	C	A	A
64	B/o Nadhiya	3/365	Mch	D	A	2.7	D	5	D	B	50%	A	A	A
65	B/o Ranjitha	1/365	Fch	A	A	0.8	A	6	D	C	50%	C	A	A
66	B/o Sangeetha A	1/365	Mch	C	A	1.4	A	5	D	B	50%	C	A	A

SNO	NAME	AGE	SEX	GA	MODE OF DELIVERY	BIRTH WEIGHT	DIAGNOSIS	DOWNES SCORE	DURATION OF CPAP	PEEP	FIO2	STEROIDS	COMPLICATION	OUTCOME
67	B/o Punitha	1/365	Mch	B	C	1.3	A	5	D	C	50%	B	A	A
68	B/o Saraswathi	1/365	Fch	C	C	1.5	A	5	D	B	50%	C	A	A
69	B/o Yamuna	1/365	Mch	C	A	2.5	C	4	C	B	40%	C	A	A
70	B/o Thilaga	1/365	Fch	C	A	1.8	A	5	C	B	50%	B	A	A
71	B/o Jayapradha	1/365	Mch	B	C	1.2	A	5	D	B	40%	B	A	A
72	B/o Kurshith Begam	1/365	Mch	B	A	1.1	A	5	D	C	50%	C	A	A
73	B/o Lakshmi	1/365	Mch	B	C	1.1	A	4	D	B	50%	C	A	A
74	B/o Shobana	1/365	Fch	B	C	1.2	A	6	D	C	60%	B	B	B
75	B/o Surya	1/365	Fch	C	B	2.2	B	4	B	A	40%	B	A	A
76	B/o Jothilakshmi	1/365	Fch	D	C	2.8	C	4	C	B	40%	A	A	A
77	B/o Iyyammal	1/365	Fch	C	C	2.2	A	4	C	A	40%	C	A	A
78	B/o sneha	1/365	Fch	C	A	2	A	5	C	B	50%	B	A	A
79	B/o Karunya	1/365	Mch	C	C	2.2	A	4	D	B	40%	C	A	A
80	B/o Eswari	1/365	Fch	C	C	2.2	B	5	D	B	50%	A	A	A
81	B/o Gotha	1/365	Fch	C	A	1.7	A	4	D	B	40%	B	A	A
82	B/o Baby	1/365	Fch	C	A	2.5	B	4	C	A	30%	C	A	A
83	B/o Thulasimani	1/365	Mch	D	A	3	C	4	D	B	40%	A	A	A
84	B/o Keerthiga	1/365	Mch	D	A	3.2	D	5	D	B	50%	A	A	A
85	B/o Deepa	1/365	Mch	C	C	1.2	A	5	D	B	40%	B	B	A
86	B/o Keerthana	1/365	Fch	C	B	2.2	A	4	C	B	40%	C	A	A
87	B/o Poongodi	1/365	Fch	C	C	2	A	5	D	B	50%	B	A	A
88	B/o Jayashree	1/365	Mch	C	C	2.2	B	4	B	A	40%	B	A	A
89	B/o Manju	1/365	Fch	D	A	2.2	C	5	C	B	50%	A	A	A
90	B/o Kalpana	1/365	Mch	C	B	2.5	B	4	D	B	40%	A	A	A
91	B/o Priyadharshini	1/365	Fch	C	C	2.2	A	5	D	B	50%	A	A	A
92	B/o Lakshmi	1/365	Mch	C	C	2.25	A	4	C	A	30%	A	A	A
93	B/o Vijayakumari	1/365	Mch	B	C	1.2	A	6	D	C	50%	A	A	B
94	B/o Ambika	1/365	Mch	C	C	2	A	5	C	B	40%	B	A	A
95	B/o Vanitha	1/365	Fch	B	C	1.2	A	5	D	B	50%	B	A	A
96	B/o Dhanalakshmi	1/365	Mch	C	A	1.2	A	5	D	B	40%	C	A	A
97	B/o Deepa	1/365	Mch	C	A	2.3	B	5	C	B	30%	A	A	A
98	B/o Radhika	1/365	Mch	B	C	1.5	A	4	D	B	40%	C	A	A
99	B/o Selvi	1/365	Fch	B	C	1.2	A	5	D	B	50%	C	A	A
100	B/o Sharmila banu	1/365	Mch	C	B	2.1	A	4	A	A	30%	C	A	A

SNO	NAME	AGE	SEX	GA	MODE OF DELIVERY	BIRTH WEIGHT	DIAGNOSIS	DOWNES SCORE	DURATION OF CPAP	PEEP	FIO2	STEROIDS	COMPLICATION	OUTCOME
101	B/o Kaliyammal	1/365	Mch	B	C	1.3	A	5	D	B	40%	C	A	A
102	B/o Priyanka	1/365	Fch	B	C	1.3	A	5	D	B	40%	C	A	A
103	B/o Kokila A	1/365	Mch	C	C	1.5	A	6	D	C	50%	B	A	A
104	B/o Kokila B	1/365	Fch	C	C	1.3	A	5	D	B	40%	B	A	A
105	B/o Nivetha	1/365	Fch	C	A	1.2	A	5	C	B	40%	A	A	A
106	B/o Rafia Basha	1/365	Mch	C	B	2.2	B	4	B	A	30%	C	A	A
107	B/o Suguna	1/365	Fch	B	C	1.3	A	5	D	B	40%	C	A	A
108	B/o Manimegalai	1/365	Fch	C	C	2.1	C	5	B	A	40%	C	A	A
109	B/o Amsa	1/365	Fch	B	C	1.3	A	6	D	C	50%	A	A	B
110	B/o Malliga	1/365	Mch	A	C	0.9	A	6	D	C	50%	B	B	B
111	B/o Hemavathi	1/365	Mch	C	A	1.7	A	5	D	B	40%	A	A	A
112	B/o Kowsalya	1/365	Mch	C	A	3	A	4	A	A	40%	A	A	A
113	B/o Rajeshwari	1/365	Fch	C	C	1.3	A	5	C	B	40%	A	A	A
114	B/o Lalitha	1/365	Mch	D	A	2.25	C	5	C	B	50%	A	A	A
115	B/o Baby	1/365	Mch	C	C	2.2	B	4	B	A	30%	C	A	A
116	B/o Sheela devi	1/365	Mch	C	C	2.3	C	5	D	B	40%	C	A	A
117	B/o Vijayalakshmi	1/365	Fch	D	A	3	B	4	C	B	30%	A	A	A
118	B/o Anandhanayagi A	1/365	Fch	A	C	0.75	A	6	D	C	60%	C	A	B
119	B/o Anandhanayagi B	1/365	Fch	A	C	0.7	A	6	D	C	60%	C	A	B
120	B/o Lakshmi	1/365	Mch	C	A	2.2	A	5	C	B	40%	C	A	A
121	B/o Bharathi	1/365	Mch	C	C	1.7	A	5	D	B	40%	C	A	A
122	B/o Nithya	1/365	Fch	B	C	1	A	5	D	C	50%	C	A	A
123	B/o Sri Poorani	1/365	Mch	C	A	2.2	A	5	D	B	40%	C	A	A
124	B/o Sundari	1/365	Mch	C	A	2	C	4	B	A	30%	C	A	A
125	B/o Lavanya A	1/365	Fch	B	C	1.1	A	6	D	C	50%	C	A	B
126	B/o Shivaranjani	1/365	Mch	C	C	1.3	A	5	D	B	40%	C	A	A
127	B/o Lavanya B	1/365	Fch	B	C	1.2	A	5	D	B	50%	C	A	A
128	B/o saroja	1/365	Mch	B	C	1.4	A	5	D	B	40%	C	A	A
129	B/o Radhika	1/365	Mch	C	A	1.7	A	5	C	B	40%	C	A	A
130	B/o Sushmitha	1/365	Fch	D	A	3	C	5	C	B	40%	A	A	A
131	B/o Pachaiyammal	1/365	Fch	C	C	2.8	B	4	D	B	40%	B	A	A
132	B/o Sivaneya	1/365	Mch	C	C	2.75	C	5	D	B	50%	C	A	A
133	B/o Maheswari	1/365	Mch	B	C	1.7	A	5	D	B	40%	C	A	A
134	B/o Kamatchi	1/365	Mch	D	C	3.2	E	4	A	A	30%	A	A	A
135	B/o Rosi	1/365	Mch	A	C	0.9	A	6	D	C	60%	B	A	B

SNO	NAME	AGE	SEX	GA	MODE OF DELIVERY	BIRTH WEIGHT	DIAGNOSIS	DOWNES SCORE	DURATION OF CPAP	PEEP	FIO2	STEROIDS	COMPLICATION	OUTCOME
136	B/o Kamatchi	1/365	Mch	C	C	1.12	A	5	D	B	50%	C	A	A
137	B/o Durga	1/365	Mch	C	A	2	A	4	C	B	40%	C	A	A
138	B/o Soundaryam	1/365	Fch	C	C	1.8	B	5	D	B	50%	B	A	A
139	B/o Jayanthi	1/365	Fch	A	C	0.75	A	6	A	C	60%	C	A	B
140	B/o Kavipriya	1/365	Fch	B	C	1.7	A	5	C	B	50%	C	A	A
141	B/o Priyadharshini	1/365	Mch	C	C	1.6	A	4	C	A	40%	C	A	A
142	B/o Poornima	1/365	Mch	C	A	1.5	A	5	D	B	40%	C	A	A
143	B/o Priya	1/365	Fch	C	B	2.7	B	4	C	A	40%	A	A	A
144	B/o Ranjitha	1/365	Mch	C	C	2.5	A	5	D	B	40%	C	A	A
145	B/o Nasreen Nisha	1/365	Mch	C	C	1.3	A	5	D	B	40%	C	A	A
146	B/o Eswari	1/365	Fch	B	C	1.7	A	6	D	C	50%	C	A	B
147	B/o Mahalakshmi	1/365	Fch	C	C	2.1	A	5	D	B	40%	C	A	A
148	B/o Stella	1/365	Fch	D	A	2.8	C	5	B	B	40%	A	A	A
149	B/o Monika	1/365	Mch	D	A	3	B	5	D	B	40%	A	A	A
150	B/o Saranya	1/365	Mch	D	B	2.5	A	5	D	B	40%	A	A	A
151	B/o Kalavathi	1/365	Mch	C	C	1.2	A	4	D	B	40%	C	A	A
152	B/o Soundarya	1/365	Fch	C	C	2.7	B	4	C	A	40%	A	A	A
153	B/o Prabha	1/365	Mch	C	C	1.4	A	5	D	B	40%	C	A	A
154	B/o Bhuvaneshwari	1/365	Mch	C	C	1.2	A	5	D	B	40%	C	A	A
155	B/o Abirami	1/365	Mch	D	B	2.3	B	5	D	B	50%	A	A	A
156	B/o Shanmugapriya	1/365	Fch	D	C	2.8	C	4	C	A	40%	A	A	A
157	B/o Kasthuri	1/365	Fch	C	C	1.2	A	5	C	B	40%	C	A	A
158	B/o Gunavathi	1/365	Mch	C	C	1.5	A	6	C	C	50%	B	A	B
159	B/o Vinodha	1/365	Mch	C	A	2.25	A	5	C	B	40%	C	A	A
160	B/o Sudha	1/365	Mch	D	C	2.4	B	5	C	B	40%	A	A	A
161	B/o Jothini	1/365	Mch	C	C	2.9	C	5	C	B	405%	C	A	A
162	B/o Sandhya A	1/365	Fch	C	C	1.9	A	5	C	B	40%	C	A	A
163	B/o Sandhya B	1/365	Fch	C	C	1.75	A	4	D	B	40%	C	A	A
164	B/o Seetha	1/365	Fch	D	A	3.5	C	5	B	A	30%	A	A	A
165	B/o Nandhini	1/365	Fch	C	C	2.3	A	4	C	A	30%	C	A	A
166	B/o Amudha	1/365	Mch	C	C	2.5	B	5	D	B	40%	B	A	A
167	B/o Parameshwari	1/365	Mch	C	A	2.3	A	5	D	B	40%	B	A	A
168	B/o Nithya	1/365	Mch	C	C	1.9	A	5	D	B	40%	B	A	A
169	B/o Sandhya	1/365	Mch	C	C	1.7	A	5	D	B	50%	B	A	A
170	B/o Sulochana	1/365	Fch	C	B	2.1	B	4	D	A	30%	B	A	A
171	B/o sandhya	1/365	Mch	C	C	2.5	A	6	D	C	60%	A	A	B

SNO	NAME	AGE	SEX	GA	MODE OF DELIVERY	BIRTH WEIGHT	DIAGNOSIS	DOWNES SCORE	DURATION OF CPAP	PEEP	FIO2	STEROIDS	COMPLICATION	OUTCOME
172	B/o Ellammal	1/365	Mch	D	C	3.2	C	5	D	B	40%	A	A	A
173	B/o Pavithra	1/365	Mch	B	C	1.2	A	6	D	C	50%	B	B	B
174	B/o Selvarani	1/365	Mch	C	A	2.7	A	4	A	A	30%	A	A	A
175	B/o Mariyammal	1/365	Mch	C	B	2.1	A	6	D	C	50%	B	A	B
176	B/o chitra	1/365	Fch	A	C	0.9	A	6	B	C	50%	B	A	B
177	B/o Latha	1/365	Mch	C	C	1.9	A	5	C	B	40%	C	A	A
178	B/o Bhuvaneshwari	1/365	Mch	B	C	1.6	A	5	D	B	50%	B	A	A
179	B/o Nandhini	1/365	Mch	B	C	1	A	5	D	C	50%	C	A	A
180	B/o Divya	1/365	Fch	C	C	2.4	C	5	D	B	40%	B	A	A
181	B/o Kanimozhi A	1/365	Fch	B	C	1.2	A	5	D	B	50%	B	A	A
182	B/o Kanimozhi B	1/365	Mch	B	C	1.38	A	5	D	B	40%	B	A	A
183	B/o Alagammal	1/365	Mch	B	A	1	A	6	C	C	60%	B	A	B
184	B/o Mariyammal	1/365	Fch	D	B	2.7	B	4	C	A	30%	A	A	A
185	B/o Rupashree	1/365	Fch	C	C	1.4	A	5	D	B	40%	A	A	A
186	B/o Priya	1/365	Mch	C	C	1.6	A	6	D	C	50%	B	A	B
187	B/o sangeetha	1/365	Mch	C	C	1.7	A	5	C	B	40%	C	A	A
188	B/o sivapriya	1/365	Fch	B	C	1.25	A	6	D	C	60%	B	A	B
189	B/o saradha	1/365	Fch	C	C	2.5	C	5	D	B	40%	B	A	A
190	B/o Kalaivani A	1/365	Fch	C	C	1.9	A	5	D	B	40%	C	A	A
191	B/o Kalivani B	1/365	Fch	C	C	1.8	A	4	D	A	40%	C	A	A
192	B/o sasikala	1/365	Fch	C	C	1.3	A	5	D	B	40%	B	A	A
193	B/o sathyavani	1/365	Mch	C	A	1.7	A	5	D	B	50%	B	A	A
194	B/o Mahalakshmi A	1/365	Mch	C	C	1.4	A	4	C	A	40%	B	A	A
195	B/o Mahalakshmi B	1/365	Mch	C	C	1.3	A	4	C	A	40%	B	A	A
196	B/o Manimegalai A	1/365	Fch	B	C	1.2	A	6	D	C	60%	B	A	B
197	B/o Manimegalai B	1/365	Fch	B	C	1	A	6	D	C	60%	B	B	B
198	B/o Jeevitha	1/365	Mch	B	C	1	A	6	B	C	60%	A	A	B
199	B/o Sneha	1/365	Mch	B	C	1.02	A	5	D	B	40%	C	A	A
200	B/o Tharani	1/365	Mch	D	B	3.2	B	4	C	A	30%	A	A	A