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Cross-sectional study on factors associated with poor outcome among ventilated neonates in a rural tertiary care hospital

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Abstract

Background: Major causes of newborn deaths in India are prematurity (35%), neonatal infections (33%), birth asphyxia (20%) and congenital malformations (9%), which are the common indications for mechanical ventilation. Various studies in developing countries have shown a mortality rate in the range of 40–60% in ventilated babies.

Objectives: To assess the risk factors associated with poor outcome among the ventilated neonates.

Materials & Methods: This retrospective study was done in rural tertiary care hospital, Kuppam, Andhra Pradesh for 2 months. Data were collected from the hospital records of the ventilated neonates in the past 1 year. 50 such records with data regarding factors associated with poor outcome among the ventilated neonates admitted to NICU were included.

Results: Out of total 50 ventilated neonates, 20 neonates (40%) died. Factors significantly associated with poor outcome among these neonates included Gestational age < 36 weeks (70%), Birth weight < 2.5kg(56%), Sepsis(28%), Shock (24%), Pulmonary haemorrhage (34%), thrombocytopenia (96%).

Conclusion: Gestational age < 35 weeks, Birth weight < 2.5 kg, sepsis, shock, pulmonary haemorrhage, Initial Ph < 7.0, ThromBo cytopenia are significant factors associated with poor outcome in ventilated neonates.

Keywords: Ventilated Neonates, Mechanical Ventilation, Preterm babies

Introduction

Each year in India there are 0.748 million newborn deaths that accounts for 26% of world's neonatal deaths more than half of the under five deaths happen in first 28 days of life and three quarters occur in first week of life. The major causes of newborn deaths in India are prematurity (35%), neonatal infections (33%), birth asphyxia (20%) and congenital malformations (9%), which are the common indications for mechanical ventilation.[1]

Neonatal mortality accounts for nearly two thirds of infant mortality and half of under 5 mortalities in India. It is possible to increase neonatal survival and improve the quality of life only through prompt and adequate management of critically ill newborn. Mechanical ventilation refers to various artificial means to support oxygenation and ventilation. The goal of mechanical ventilation is to maintain adequate pulmonary gas exchange with minimum lung injury, oxygen toxicity and to reduce patient work of breathing. Outcome of such neonates requiring mechanical ventilation is dependent on multiple factors like, primary disease condition, gestational age, birth weight, associated co-morbid clinical conditions.[2]

It is possible to increase survival of neonates and improve the quality of life only through prompt and adequate management of neonates which is not possible without respiratory intensive care and assisted ventilation.

Hyaline membrane disease, perinatal asphyxia, sepsis and congenital malformations are the common causes of neonatal mortality in premature babies.[3]

Advances in perinatal and neonatal care have significantly reduced neonatal morbidity and mortality rates.

Outcome in sick infants has improved significantly, mostly due to more effective newborn intensive care and aggressive respiratory and cardiovascular support. Various studies in developing countries have shown a mortality rate in the range of 40–60% in ventilated babies.[4]

Still, mechanically ventilated neonates have a high fatality, for which, identification of risk factors is important for reduction in mortality among them.[5]

Objectives of the study

To assess the risk factors associated with poor outcome among the ventilated neonates.

Materials & Methods

Study design: Retrospective study

Study setting: Rural tertiary care hospital, Kuppam, Andhra Pradesh

Study period: 2 months (May-June, 2022)

Source of data: Hospital records having the data regarding the factors associated with poor outcome among the ventilated neonates in the hospital in the past 2 years.

Sampling method: Purposive sampling

Sample size: 50

Inclusion & Exclusion Criteria

All the records containing data regarding factors associated with poor outcome among the ventilated neonates admitted to NICU will be included.

Those with incomplete data will be excluded.

Study tools

Pre-designed structured questionnaire for collecting details on socio-demographic and other details of the neonates apart from details regarding factors associated with poor outcome among the ventilated neonates.

Method of collection of data

After obtaining permission from the hospital authorities, all the records will be checked for details on factors associated with poor outcome among the ventilated neonates and the relevant data will be noted for further analysis.

Statistical Analysis of data

The data will be entered into MS Excel and further analyzed using SPSS version 23. Descriptive statistics will be done by percentages and mean, inferential statistics done by tests of significance like Chi- square, t-test etc, where p<0.05 will be statistically significant.

Observation and results

Gender wise distribution of neonates.

Table 1:

Gender	survived		Expired		Frequency n=50	Percentage (%)
Female	20	40	7	24	27	54
Male	10	20	13	38	23	46
Total	30		20		50	100.0

Of the 50 babies analyzed 54% babies were female babies and 46% babies are male babies.

Comparison of gestational age between the two groups.

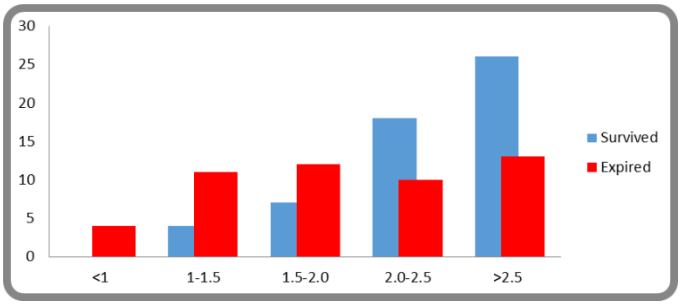
Table 2:

Gestational age	Survived	Expired	Frequency n=105 Percentage(%)	
<32wks	5	11	16	32
32-36wks	11	8	19	38
36wksandabove	14	1	15	30
Total	30	20	50	100.0
Mean± SD	35.2±2.9	33.5±4.3	34.8±2.3	
χ 2=10.971, P Value =0.041, result is significant at p < .05			Range=26-42 WKS	

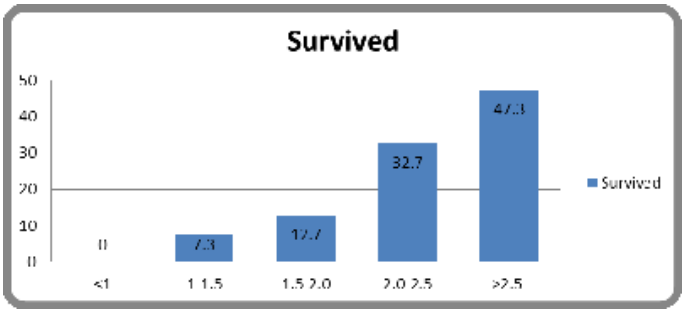
There mean gestational age of survived group was 35.2±2.9 weeks and expired group mean gestational age was 32.5±4.3 weeks. The difference of mean gestational ages between the two groups was statistically significant (P<0.05)As per the gestational age 32% babies were less than 32 weeks, 38% babies were between 32 to 36 weeks,30% babies were between 36 and above.

Comparison of birth weights between the survived and expired

Graph 1:



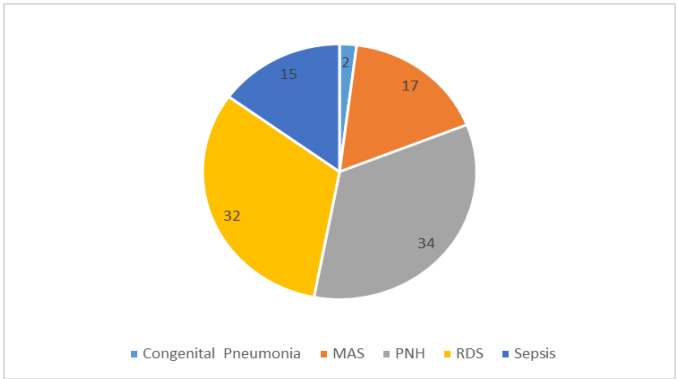
Graph 2:



From the above data we analyzed that survival rate was directly proportional to the birth weight.

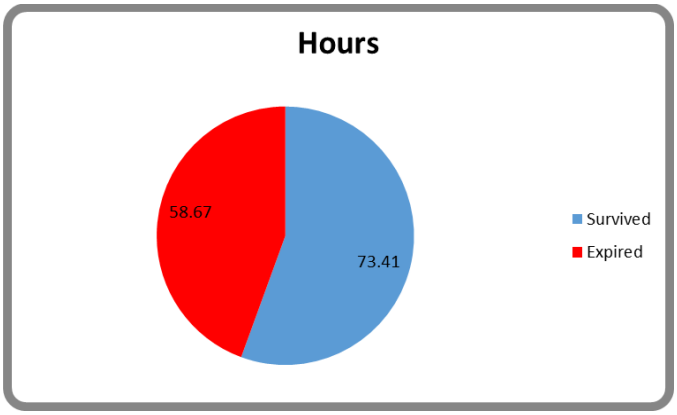
Survival rate among different disease condition.

Graph 3:



Duration ventilation between the two group in hours.

Graph 4:



Incidence among different Indication of ventilation

Table 3:

Indication	Frequency	%
GC Poor	15	30.0
RD>7/10	30	60.0
Respiratory failure	5	10.0
Total	50	100.0

From the above data we observed that most of the babies were intubated for the indication of respiratory distress scoring morethan7/10 followed by poor GC

Table 4: complications of ventilation

Complications of ventillation	Frequency	Percentage
Air leak	7	14
septicemia	14	28
Tube block	13	26
Shock	12	24
Pulmonary Hemorhage	17	34
VAP	15	30

30 % had Ventilator associated pneumonia,34% had Pulmonary Hemorhage, 24 had shock ,26% has tube block.28% had septicemia,14 had air leak complications.

Discussion

The availability of a large number of computerized ventilators to provide assisted ventilation has transformed modern neonatal care. There are two types of ventilators based on their working principle: pressure limited and volume limited. Constant flow generators are ventilators that provide a continuous flow of gases throughout the respiratory cycle. They provide stable and consistent tidal volume minute ventilation, regardless of lung compliance.[6] The current study's goal is to identify and prevent the risk factors that contribute to poor outcomes in ventilated newborns. The clinical profile of ventilated neonates will be studied and correlated with the outcome, and we studied the influence of gestational age and birth weight on the immediate outcome in ventilatory, the mean duration of mechanical ventilation required, and the complications associated with mechanical ventilation.

Totally 50 neonates were studied, among them 54 % babies were male and46%females, As Kollef [7] and Riya's et al. [8] discovered, gender and age at admission had no statistically significant association with outcome. However, the gestational age and birth weight of the neonate had an impact on the outcome. Mathur et al and Hossain et al. [10] have both reported on the impact of low birth weight and prematurity on neonatal survival. In this study below 32 weeks of gestational age are 22.8%, 32-36 weeks are28.5%, and > 36weeks were 41.9%. This is comparable with the study done by Yadav M[17], Mohammed Ajaz Mohammed Haneef Shaikh and Prajakta .[11,12]. in contrast to the number of babies less than 32 weeks was 43% in a study done by NC Mathur. The smallest survivor on ventilator was 1050 grams and gestational age of 30 weeks. In our study weight distribution was found to have 4% in <1kg, 14 % in 1-1,5kg,14%in1.5-2kg,18%in2-2.5kgand37%in>2.5kg.This is comparable with the study done by Basavaraj M Patil, Sandeep VH [13]and contrast to the

number of babies between 1 to 1.5kg in a study done by NC Mathur38.79% and S. Nangia had 61.22%.[14]

Indication of mechanical ventilation in our study include Congenital Pneumonia,MAS,PNH,RDS,Sepsis. Respiratory distress syndrome (RDS) was common reason for ventilation in our study,

This finding is consistent with other studies. The survival rate in babies with RDS was 65.38%, which is higher than the rate reported by Singh et al.[9]

30 % had Ventilator associated pneumonia,34% had Pulmonary Hemorhage, 24% had shock ,26% has tube block .28% had septicemia,14 %had air leak complications. This is correlated with other studies.NC Mathur who had high incidence of septicemia and Basavaraj M Patil,[13] SandeepVH, This correlated with L. Krishnan[15] who report Ed only 4.4% septicemia. In our study pulmonary hemorrhage was occurred in 15% of cases. This correlated with S. Nangia (9.5%)[16] and comparable with study of Basavaraj M Patil, Sandeep VH [13]which is 24.49%. Incidence of pneumothorax was found to be 6% in our study which was comparable with the study done by Shahjadi Nasreen Sultana,[16]

In this study, perinatal asphyxia and neonatal sepsis were linked to increased mortality. This is not surprising given that perinatal asphyxia, which causes hypoxic ischemic encephalopathy, is caused by anoxic brain injury, and the prognosis is extremely poor for severely affected infants who would require ventilation; the same is true for neonates with sepsis, which causes multi-organ failure.

Mechanically ventilated babies are especially vulnerable because artificial airways bypass the body's defenses against pathogens inhaled. Intubation-related pharyngeal and tracheal lesions promote bacterial colonisation by impairing swallowing reflex and ciliary function. As a result, these infants may develop pneumonia and sepsis. Non survivors had significantly higher rates of hospital acquired sepsis (p value: 0.05).

Conclusion

- As birth weight and gestational age increased, so did the survival rate. Babies weighing less than 1.5 kg had a less survival rate, while those weighing more than 2.5 kg. Babies born before the gestational age of 32 weeks had a les survival rate than for babies born after the gestational age of 37 weeks. Regardless of the diagnosis or indication for ventilation, the survival rate increased with birth weight and gestational age. Perinatal hypoxia,respiratory distress syndrome, meconium aspiration syndrome,Sepsis, and congenital pneumonia, are the most common indications. PNH had the highest rate of survival, followed by RDS., congenital pneumonia, and MAS. The most common complication encountered, developed shock, had a better outcome of survival rate. while air leak and pulmonary haemorrhage had less outcomes. Survival rates for tube block, Sepsis, and VAP were 5%, 31%, and 18%, respectively. Perinatal hypoxia caused the most complications, followed by respiratory distress syndrome and meconium aspiration syndrome.

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