



Outcome of Neonates on Mechanical Ventilation in the Newborn Care Unit of a Rural Tertiary Care Center in India

Dr.Thageeru Mahesh kumar¹, Dr. Srihari Alapati², Dr. Beeregowda³, Dr. Akshath K S⁴, Dr.Pavan kalyan B⁵

¹Junior resident, Department of paediatrics, Sri Narasimharaja district hospital, Kolar, Karnataka

²Head of the department, Department of paediatrics, Sri Narasimharaja district hospital, Kolar, Karnataka

³Senior consultant, Department of paediatrics, Sri Narasimharaja district hospital, Kolar, Karnataka

⁴Junior resident, Department of paediatrics, Sri Narasimharaja district hospital, Kolar, Karnataka

⁵Junior resident, Department of paediatrics, Sri Narasimharaja district hospital, Kolar, Karnataka

Corresponding Author: Dr. Beeregowda³, Senior consultant in Pediatrics, Sri Narasimharaja district hospital, Kolar, Karnataka

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ABSTRACT

Introduction : The survival rates of neonates with severe respiratory distress from a variety of causes have improved dramatically with mechanical ventilation. We conducted this study to estimate the ventilatory outcome of neonates in terms of survival rate.

Materials and Methods : This was a retrospective study conducted on 137 neonates that satisfied our inclusion criteria and requiring invasive mechanical ventilation that were admitted in the neonatal unit of rural tertiary care centre in India from August 2020 to July 2023. The data regarding those babies requiring invasive mechanical ventilation was collected from our unit records and indications, survival outcome and risk factors associated was analysed.

Results: During the period of our study 137 among 2084 neonates required invasive mechanical ventilation and satisfied our inclusive criteria. Of them 75 (54.7 %) being male and 62 (45.3 %) being female neonates. The most common cause requiring invasive mechanical ventilation in our study being Respiratory distress syndrome (51.8%) followed by perinatal asphyxia (22.6%) and the overall survival rate of neonates on mechanical ventilation was 53.2% with shock and pulmonary haemorrhage being significant complications associated with the mortality of the neonates.

Conclusion : In our study, the survival rate of neonates receiving invasive mechanical ventilation was 53.2%. The commonest indication for invasive mechanical ventilation was respiratory distress syndrome linked to prematurity. Strengthening the neonatal units in rural public sector hospitals can improve the survival outcome by ensuring timely access to parenteral nutrition and surfactant supplies.

Key words: Neonatal ventilation, Invasive ventilation, Mechanical ventilation, Survival outcome, Respiratory distress syndrome

I. INTRODUCTION

Newborn babies are most vulnerable to various insults in the first 28 days of life. Respiratory distress is one of the commonest disorders of newborn. It occurs among 4 - 7 % of all neonates^{1, 2} and is the reason for 30 - 40 % of admissions in the Neonatal Intensive Care Unit (NICU). Respiratory distress is more common among preterm (30 %) and post-term (21 %) than among term neonates (4.2 %) ². Neonates with respiratory distress have high chances of landing up in failure and are subjected to mechanical ventilation which is a kind of artificial ventilation and potentially lifesaving. Survival rate in artificially ventilated neonates is reported as 64% by Trotman³ and 67.9% by Karthikeyan and Hossain⁴ though survival of such neonates has been higher in developed countries⁵. This study was done to know the current scenario of our unit and thereby to improve the ventilatory outcomes of neonates admitted in our newborn care unit.

II. METHODOLOGY

Aim : To estimate the ventilatory outcome of neonates in terms of survival and mortality.

Objectives:

1. To estimate the ventilatory outcome of neonates in terms of survival rate.
2. To estimate the proportion of causes leading to the mechanical ventilation in our unit.

Methodology:

- Place of study: SNR District Hospital, Kolar, Karnataka, India.
- Period of study : August 2020 to July 2023



- Type of study: Retrospective descriptive study.
- Inclusion criteria:
 1. Neonates with respiratory distress requiring invasive mechanical ventilation.
 2. Neonates delivered by caesarian section or vaginal delivery.
- Exclusion criteria:
 1. Neonates with respiratory distress requiring non invasive mechanical ventilation
 2. Neonates with Congenital anomalies.
 3. Post surgical babies
 4. Neonates suspected with metabolic syndromes.

Method of collecting data:

Neonates with respiratory distress in respiratory failure admitted in our newborn care unit was assessed clinically for the need of invasive mechanical ventilation as per our unit protocols. The indications for initiation of invasive mechanical ventilation were: (i) PaO2 <50 mmHg, (ii) PaCo2 >60 mmHg, (iii) intractable or recurrent

apnea, (iv) gasping or poor respiration, (v) O2 saturation 60 mmHg despite CPAP pressure of 7–8 cm H2 O and FiO2 of 0.8 or recurrent episodes of apnea⁶.

The data regarding those babies requiring invasive mechanical ventilation was collected from our unit records and analysed.

III. RESULTS

During the period of our study 2084 neonates admitted in our neonatal unit, out of which 137 neonates required invasive mechanical ventilation and satisfied our inclusive criteria. Among the 137 neonates , 75 (54.7 %) being male and 62 (45.3 %) being female neonates. The most common cause requiring invasive mechanical ventilation in our study being Respiratory distress syndrome (51.8%) followed by perinatal asphyxia (22.6%), meconium aspiration syndrome (13.9%) ,congenital pneumonia (8%), neonatal sepsis (1.5%), feed aspiration (1.5%) and meningitis (0.7%) (**Table 1**)

Table 1 :Diagnosis of the neonates requiring invasive mechanical ventilation in the study

sl.no.	Diagnosis	No.of cases in the study	Percentage of cases in the study
1	Respiratory distress syndrome (HMD)	71	51.8%
2	Perinatal asphyxia	31	22.6%
3	Meconium aspiration syndrome	19	13.9%
4	Pneumonia	11	8%
5	Neonatal sepsis	2	1.5%
6	Feed aspiration	2	1.5%
7	Meningitis	1	0.7%

Neonates with gestational age of < 32 weeks are administered with surfactant therapy and initially started on CPAP therapy .Those neonates that are not successful on cpap were ventilated. During the period of this study, 53.2% neonates were extubated successfully and discharged and 46.8 % neonates were not survived. During the course of treatment complications recorded were neonatal sepsis,disseminated intravascular coagulation, shock,pulmonary haemorrhage, intraventricular haemorrhage, pneumothorax,

hypoglycemic episodes. Most common organism identified with neonatal sepsis among the ventilated neonates were Klebsiella followed by staphylococcus .Shock and pulmonary haemorrhage were significantly associated with the mortality of the neonates.

Among all the neonates in the study 71 babies diagnosed with RDS, 37 neonates (52.1%) were survived and got discharged and 11(57.9 %) among 19 neonates diagnosed with meconium aspiration syndrome were survived ,17 (54.8 %)



among 31 neonates diagnosed with perinatal asphyxia were extubated and discharged. 7 (63.6%) among 11 neonates diagnosed as pneumonia was extubated successfully. one neonate

(50 %) with feed aspiration and 1 neonate (50 %) with neonatal sepsis on mechanical ventilation was survived.

Table 2: Distribution of neonates requiring mechanical ventilation by weight

Weight range in grams	No. of neonates	Percentage
< 999	31	22.6 %
1000 - 1499	15	10.9 %
1500 - 1999	11	8%
2000 - 2499	21	15.3 %
2500 - 2999	37	27 %
3000 - 3499	17	12.4 %
>3500	5	3.6 %

Table 3: Distribution of neonates requiring mechanical ventilation by gestational age

Gestational age in weeks	No. of neonates
< 28	27
28+1 days to 31+ 7 days	11
32 +1days to 33+7 days	11
34 +1days to 36+7 days	23
37 +1days to 38+7 days	63
39 +1days to 40+7 days	2

IV. DISCUSSION

Various Indian studies report a survival rate of 40% to 60%.⁷. In this study, we attempted to determine the survival outcome of the neonates on mechanical ventilation. The percentage of neonates admitted in our neonatal unit requiring mechanical ventilation during our study was 6.57% and predominantly male neonates (54.7 %). The mean gestation age of the neonates in our study requiring mechanical ventilation being 35.825 ± 2 weeks with median gestational age being 37 weeks. Mean birth weight requiring mechanical ventilation being 2.05kg ± 915 grams. Most of the neonates in our study were preterm (52.55 %) . Respiratory distress syndrome (HMD) was the most common indication of mechanical ventilation in our study similar to the studies done by Singh M et al⁶, Iqbal Q et al⁷, Das, Bijoy Kumar et al⁸, and Thakkar,

Pareshkumar A. et al⁹. Perinatal asphyxia is the second most common indication of mechanical ventilation in our study similar to the study done by Nangia S et al¹⁰. The highest survival rate in our study was congenital pneumonia (63.6 %) followed by meconium aspiration syndrome (57.9 %) and perinatal asphyxia (54.8 %).

Of the all neonates in our study 79 (57.7 %) neonates developed complications. 41 (51.89 %) neonates developed sepsis , which was the most common complication in our study similar to the study done by Singh M et al⁶, 16 (20.25 %) neonates developed shock , 12 (15.18%) neonates developed pulmonary haemorrhage which was most common complication in premature neonates in our study.

In this study, mortality in ventilated neonates was 46.8%, which is comparable to mortality of 43%



reported by Iqbal Q et al⁷., Das, Bijoy Kumar et al⁸.,and Thakkar, Pareshkumar A. et al⁹.,reported figures of 43.3% and 52%, respectively.whereas in

the studies done by Hossain et al¹¹., and mathur et al¹²., mortality rate was very high which was 70.6 % and 74% respectively

Table 4 : Comparison of survival rates of neonates on mechanical ventilation in various studies

Indication of mechanical ventilation	Hossain et al ¹¹	Iqbal Q et al ⁷	Das, Bijoy Kumar et al ⁸	Our study
RDS	33.3%	55.3%	54.5%	52.1%
MAS	33.3%	73.3%	100%	57.9%
PA	31.6%	66.6%	42.9%	54.8%
Pneumonia	100%	40%	80%	63.6%
Neonatal sepsis	25%	35.3%	50%	50%

The survival rate in the neonates with RDS in our study was 52.1% which was almost similar to the studies done by Iqbal Q et al⁷ and Das, Bijoy Kumar et al⁸ whereas the survival rate in the study done by Hossain et al¹¹ was less than our study. Survival rates of neonates on mechanical ventilation depends on availability of surfactant especially for preterm neonates and facility for parenteral nutrition and strict protocols for sepsis control in the neonatal units which differs significantly among the developed and developing countries. Neonates with meconium aspiration syndrome has better survival outcome on mechanical ventilation in the studies done by Das, Bijoy Kumar et al⁸ and Iqbal Q et al⁷ than the outcome seen in our study whereas survival outcome with similar indication in the study by Hossain et al¹¹ was less than our study . In contrast to our findings, the studies by Hossain et al¹¹., and Das, Bijoy Kumar et al⁸., found lower survival outcomes with identical indications in their studies on neonates with perinatal asphyxia, whereas the study by Iqbal Q et al⁷., found better survival outcomes on mechanical ventilation. The survival rate of neonates with pneumonia on mechanical ventilation was 80% in Das, Bijoy Kumar et al⁸.'s study, which was higher than ours, and 100% in the study conducted by Hossain et al¹¹. In addition, compared to Hossain et al¹¹. and Das, Bijoy Kumar et al⁸., our study included a larger study sample and most of the neonates with pneumonia are outborn where most of the damage happened out of our unit . In neonates with sepsis, we saw similar survival rate i.e., 50% seen in the study done by Das, Bijoy Kumar et al⁸., and as well as better outcomes than the studies done done by Hossain et al¹¹ and Iqbal

Q et al⁷. Drug-resistant bacteria are becoming more common, and certain neonatal unit antibiograms exhibit inconsistent patterns in different studies. These changes have a substantial impact on the outcomes of sepsis-affected newborns on mechanical ventilation.

V. CONCLUSION

The survival outcome of neonates on invasive mechanical ventilation in our study was 53.2 % .The most common indication of invasive mechanical ventilation in our study being Respiratory distress syndrome followed by Perinatal asphyxia .Neonatal mechanical ventilation can have a better survival outcome when provided with timely availability of surfactant and parenteral nutrition facilities by strengthening the neonatal units in rural public sector hospitals.

Limitations: Those neonates who received exclusively CPAP or noninvasive ventilation was not the focus of our study. Apart from that we were unable to study the variables that affect morbidity, like length of hospital stay, mechanical ventilation, and NICU stay.

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Conflicts of interest There are no conflicts of interest.

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