Profile and outcome of neonates requiring mechanical ventilation

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Abstract

Background: Assisted ventilation has become an indispensable part of neonatal intensive care unit (NICU). It is one of the major supportive modality in NICU and it has definite impact on survival of sick neonates.

Objectives: 1. To study the common indications for mechanical ventilation in neonates
2. To study the factors affecting the outcome

Methods: This is a descriptive study done in 50 babies admitted to NICU at S. N. medical college during a period of one year. Information was collected in a pre-designed proforma and analysed.

Results: out of 50 neonates ventilated, 68.6% were male. Mean age, weight, gestational age were 1.56±2.05 days, 2000±690 g and 35.04±3.75 weeks respectively. 31(62%) neonates survived. HMD (34%), AOP (26%), Perinatal asphyxia (24%) were most common indications for ventilation. Mortality in AOP+HMD, HMD only, perinatal asphyxia, AOP only was 50%, 47.1%, 41.7%, 38.5% respectively. pH <6.9±0.18, bicarbonate <10.3±3.1, base excess -10.2±7.8 before ventilation, PIP mean >13.8±3.2, PIP Maximum>15.5±4.09, PEEP mean >5.3±0.59, PEEP maximum>5.8± 0.98, RR mean>35±2.7, MAP mean >9.3± 2.0, MAP maximum>10.36±3.5 had significant correlation with mortality.($p<0.05$). Pulmonary haemorrhage 44.4% is most common complication followed by sepsis 27.7% and shock 27.7%.

Conclusion: Among the numerous commonly available variables studied by us, maximum and mean peak inspiratory pressure (PIP), maximum and mean peak inspiratory pressure (PEEP), Respiratory rate maximum, mean airway pressure (MAP) maximum and mean requirement during the course of ventilation was significantly higher in the non-survivors compared to that of the survivors. pH, bicarbonate, base excess were found to be significant predictors of mortality in ventilated neonates.

Key words: Mechanical Ventilation; Indications; Outcome.

Introduction

Assisted ventilation has become an indispensable part of neonatal intensive care unit (NICU). It is one of the major supportive modality in NICU and it has a definite impact on survival of sick neonates. In India, neonatal mortality rate (NMR) is 27.7 per 1000 live births (2015). Each year in India there are 0.748 million newborn deaths that accounts for 26 percent 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[1]. 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.

The first 28 days of life-neonatal period is the most vulnerable time for child's survival. Identification of risks of fatality in ventilated neonates is compulsory in order to intervene early, decrease the mortality, and even for triage in resource limited settings.

Materials and Methods

This is a descriptive study done in Hanagal Shri Kumareshwara hospital attached to S. N. Medical College, Bagalkot which is a tertiary care medical college hospital. It was done for a period of one year (May 2014 – April 2015) in babies admitted to NICU.

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Based on a study done by Iqbal Q[2] et al, by taking mean and standard deviation of gestational age, by open EPI method with 5% level significance, power 80%, sample size was calculated as 44, rounded off to 50.

50 consecutive neonates (age 0-28 days) ventilated during the study period (Inborn and outborn) were included in the study. Babies with major congenital anomalies were excluded.

After obtaining informed consent from the parents, detailed antenatal and natal history was taken; detailed examination was done using a pre-designed and pre-structured proforma. Indications for ventilation were diagnosed based on the National Neonatal-Perinatal Database (NNPD) criteria. The babies were in pressure controlled mode and SIMV mode used during weaning.

Data was analysed in the form of percentages and proportions.

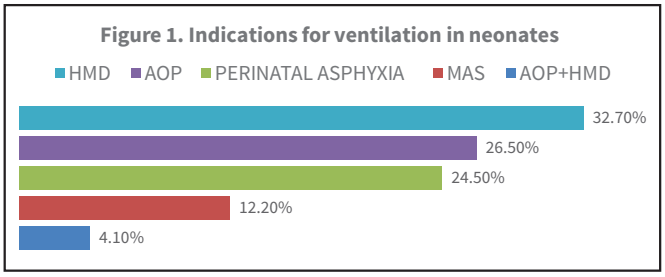
Results

Out of total 50 babies, 31 babies survived, 18 expired, and one baby got discharged against medical advice. 27 babies were born by vaginal route, 18 by LSCS and 5 by assisted delivery. General profile of the study population and their outcome in relation to various parameters are described in Table 1.

Table 1. Percentage survival in relation to the studied parameters

Survival in relation to:	Number of babies (n=50)	Percentage survival
Gender:		
Male	35	68.6%
Female	15	46.7%
Birth weight:		
<1000gram	02	0%
1000-2500gram	35	61.8%
>2501gram	13	76.9%
Gestational age in weeks:		
28-36	29	41.3%
37-41	21	57.1%
>42	0	
Downes/Silverman score at admission:		
< 6	35	62.8%
≥ 7	15	60.0%
Indication:		
Perinatal asphyxia	12	58.3%
MAS	06	100%
AOP	13	61.5%
HMD	17	52.9%
AOP+HMD	02	50.0%

(HMD-Hyaline membran disease, AOP- Apnoea of prematurity, MAS-Meconium aspiration syndrome)



(HMD-Hyaline membrane disease, AOP- Apnoea of prematurity, MAS-Meconium aspiration syndrome)

Table 2. Comparison of ventilator parameters between survivors and non- survivors

Indicators	Outcome	Number	Mean	SD	P value
PIP mean	survived	31	11.80	1.400	0.005
	death	18	13.80	3.277	0.023
PIP max	survived	31	12.68	1.739	0.002
	death	18	15.50	4.091	0.011
PEEP mean	survived	31	4.97	0.207	0.002
	death	18	5.36	0.596	0.015
PEEP max	survived	31	5.10	0.301	0.000
	death	18	5.83	0.985	0.006
FiO2max	survived	31	74.84	21.232	0.000
	death	18	96.11	9.164	0.000
Respiratory rate mean	survived	31	32.09	3.22	0.002
	death	18	35.00	2.77	0.002
MAP mean	survived	31	7.76	1.79	0.006
	death	18	9.38	2.05	0.009
MAP max	survived	31	8.28	1.93	0.011
	death	18	10.36	3.55	0.031
Ph	survived	11	7.36	0.084	0.000
	death	6	6.98	0.186	0.003

(PIP mean-peak inspiratory pressure mean, PIP max- peak inspiratory pressure maximum, PEEP mean- peak end expiratory pressure mean PEEP max- peak end expiratory pressure maximum, $Fi0_2$ –Fraction of inspired oxygen, MAP mean- mean airway pressure mean, MAP max- mean airway pressure maximum, Ph- potential of hydrogen.)

Birth asphyxia was the commonest indication for ventilation in term babies, whereas in preterm it was HMD (Figure 1).

The best outcome was observed in neonates ventilated for MAS, with a survival rate of 100%, followed by apnoea of prematurity, perinatal asphyxia and HMD.

The mean gestational age and mean birth weight of babies who survived were significantly higher in comparison to babies who expired but not statistically significant. Downes score at birth did not correlate significantly with outcome.

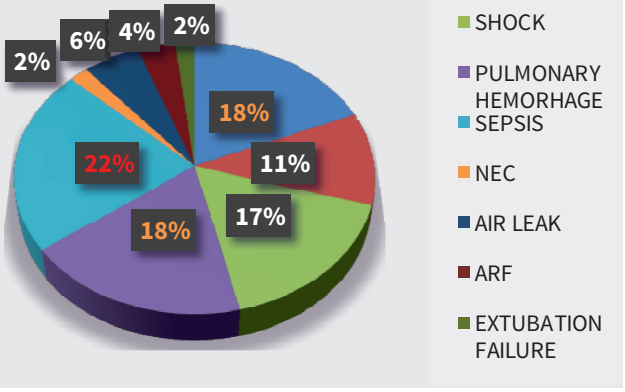
Pressure requirement during the course of ventilation was significantly higher in the non-survivors compared to that of the survivors (Table 2).

Poor Cry, Tone and activity (CTA) at birth had higher high mortality 55.6% with p value <0.05

Mortality is 100% in babies requiring both intubation and chest compressions as the mode of resuscitation p<0.05.

Indication for ventilation or comorbidity doesn't have significant impact on mortality.

Figure 2. Neonates with various complications of ventilation



(VAP- Ventilator associated pneumonia, PPHN- persistent pulmonary hypertension, NEC-Nectrotising enterocolitis, ARF-acute renal failure.)

Among the babies expired, pulmonary hemorrhage (44.4%) is the most common complication followed by sepsis (27.7%) and shock (27.7%) with significant p<0.05 (Figure 2).

Among babies who survived, 46.7% babies had no complications

Discussion

HMD is the most common indication for ventilation in our study. It is the most common indication for ventilation in studies by Riyas et al[3], Singh et al[4], Nangia et al[5] and Karthikeyan et al[6].

Apnea of prematurity is next most indication for ventilation with survival of 61.5% in our study. It is the most common indication in a study done by Ahmed SM et al[7], with survival 22.5%.

Asphyxia was the third most common indication in our study. The NNPD 2002 places birth asphyxia as the commonest primary cause of neonatal mortality, with an incidence of 28.8% among all intramural death.[8]

In our study, survival was 62%, which is comparable to that reported in various studies has ranged from 41.2% to 67.9%.[6, 9]

In the present study, the best outcome was observed in neonates ventilated for MAS, with a survival rate of 100%. MAS had the best outcome in the series by Malhotra et al.[10] and Riyas et al.[3], with 100% and 63.6% survival, respectively.

The commonest indication for ventilation in our series, HMD, had the fourth best outcome. Singh et al[4] and Schreiner et al had reported better survival in HMD in their series. Natural surfactant (bovine origin) was used in our study selectively for infants with established RDS as rescue therapy and in most cases as late rescue. Because of financial constraints, we were unable to use surfactant prophylactically.

The babies with a pH of >7.3 had a better survival than those with a pH of <7.299, with significant p value. This was similar to the observation by Mathur et al[11].

The PIP requirement of the non-survivors was significantly higher than that of the survivors. Mathur et al[11] observed a similar trend in their study, but the difference was not statistically significant.

Conclusion

In the present study, the survival of ventilated babies was 63% and the commonest indication for ventilation was HMD.

Among the numerous commonly available variables studied, pressure requirement during the course of ventilation was significantly higher in the non-survivors compared to that of the survivors.

Presence of pulmonary haemorrhage and sepsis were predictive of poor outcome.

Early recognition of complication related with ventilator support, frequent monitoring and good nursing care are keys of successful weaning of any neonate.

Limitations: Smaller sample size was a limitation. Longer duration and bigger sample size can make a better impact.

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