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ORIGINAL ARTICLE

Outcome, Clinical Profile and Risk Factors for Mortality of Neonates Necessitating Mechanical Ventilation

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ABSTRACT

Background: Assisted ventilation has turn out to be an essential part of the neonatal intensive care unit (NICU). It is one of the main methods of support in the ICU and undoubtedly influences the survival of sick newborns.

Aims: 1. To investigate common indications for mechanical ventilation in newborns 2. To investigate factors influencing the outcome.

Method: It is a descriptive study of 60 infants admitted to the Department of Pediatric Medicine in the ICU over a one-year period in the department of Paediatrics, Abbasi Shaheed Hospital. The information was gathered and analysed in a pre-designed format.

Results: Of a total of 60 infants, 46 survived, 14 died, and one infant was discharged despite medical advice. 36 children were born vaginally, 20 were born via LSCS, and 4 via assisted delivery. Postnatal asphyxia was the most common ventilation indication in full-term newborns, while HMD was present in preterm infants. The best results were obtained in ventilated infants with MAS, with 100% survival, followed by apnoea in premature infants, perinatal asphyxia, and HMD. Pulmonary haemorrhage (48.3%) was the most common complication among deceased infants, followed by sepsis (28.3%) and shock (23.4%) with a significant $p < 0.05$. There were no complications in 76.7% of the surviving infants.

Conclusions: Among the many widely available variables studied in this study, maximum and mean peak inspiratory pressure (PIP or (PEEP), maximum respiratory rate, maximum mean airway pressure (MAP) and average ventilation demand was much greater among non-survivals in comparison to the survivors. Bicarbonate, PH and excess base have been found to be important determinants of mortality in ventilated newborns.

Keywords: Indications, mechanical ventilation and Results

INTRODUCTION

Under the global birth scenario, approximately 6.45 million newborns are born in Pakistan each year and of these newborns, 41.2 deaths per 1000 live births occurs prior to the first four weeks of life. The number of infant deaths in the developed region is 3 per 1,000 live births, in Pakistan 42 per 1,000 live births, and in India 29 per 1,000 live births[1-2]. Pakistan is a resource-limited developing country in Southeast Asia with an infant mortality rate of 24.40 per 1,000 live births (World Health Statistics, 2013)[3]. Pakistan has achieved the Millennium Development Goal of reducing infant mortality[4-5]. The Sustainable Development Goals aim to reduce infant mortality to at least 12 per 1,000 live births by 2030[6]. The downward trend in mortality has been even more impressive so far, especially for infants with very low birth weight <500 g birth weight. A prerequisite for proper care for high-risk neonates is the greater availability of skilled labour and the appropriate use of mechanical ventilation[7-8]. It has recently been observed that the addition of surfactant and TPN are also factors that can be attributed to the reduction in mortality. There are factors that are only valid in a modern neonatal intensive care unit (NICU). Mechanical ventilation is an integral part of the care of modern NICUs[9]. Mechanical ventilation can be definite as the gas movement into and out of the lungs through an external source directly connected to the patient through a endotracheal or tracheostomy tube. Newborn mechanical ventilation has been practiced for several years with various form improvements[10]. It was introduced to the West in the 1960s to help infants with respiratory failure. This innovative technology has reached significant heights in rich countries, but due to its high cost, the skill requirements of professionals have limited its use in developing countries. Infants with perinatal hypoxia and asphyxia at birth, and critically ill infants who develop life-threatening apnoea, progressive respiratory failure with impending respiratory failure, or cardiovascular collapse require mechanical ventilation[11]. Therefore, mechanical ventilation has become a necessity to improve the survival of newborns in such situations. With the widespread use of mechanical ventilation in intensive care units, the survival rate of sick newborns has improved significantly[12]. The benefits of intensive care, including mechanical ventilation, are obvious, but these interventions are laborious and costly, and cannot be fully recovered. The morbidity and mortality of newborns who have so far been mechanically ventilated are also high[13]. Early detection of complications and factors affecting the outcome of treatment is important to reduce mortality in this group of newborns. Most of the data on ventilated sick newborns came from developed countries. In developing countries, such as Pakistan, where there are budgetary constraints and limited technological progress, mechanical ventilation policies must be adjusted to help reduce morbidity and mortality[14].

Assisted ventilation has become an indispensable part of the neonatal intensive care unit (NICU). It is one of the main methods of support in the ICU and undoubtedly influences the survival of sick newborns[15]. The main causes of neonatal death in Pakistan are prematurity (35%), neonatal infections (33%), suffocation (20%) and birth defects (9%) with the usual indications for mechanical ventilation. The neonatal period is the most vulnerable period for a baby to survive. Identifying the risk of death in ventilated newborns is essential for early intervention, reducing mortality, and even segregating under resource constraints.

MATERIAL AND METHODS

It is a descriptive study of 60 infants admitted to the Department of Pediatric Medicine in the ICU over a one-year period in the Abbasi Shaheed Hospital. The mean and standard deviation of the gestational age were taken and the significance level was at 5%, the power as 80%, the sample size as 60 using the EPI open method. Sixty consecutive infants (0-28 days) ventilated (out-born or inborn in hospital) during the study period were enrolled in the study. Children with significant birth defects were excluded from the study. Detailed prenatal and birth history was obtained with informed consent from parents; A detailed overview was performed using a pre-designed and preconfigured form. The indications for ventilation were identified according to the criteria of the National Neonatal-Perinatal Database (NNPD). Infants were in pressure-

controlled mode and SIMV mode was used during weaning. Data was analysed in proportions and percentage.

RESULTS

Of a total of 60 infants, 46 survived, 14 died, and one infant was discharged despite medical advice. 36 children were born vaginally, 20 were born via LSCS, and 4 via assisted delivery. The general profile of the study population and its results in terms of various parameters are presented in Table 1.

Table-1: Demographic profile of the infants

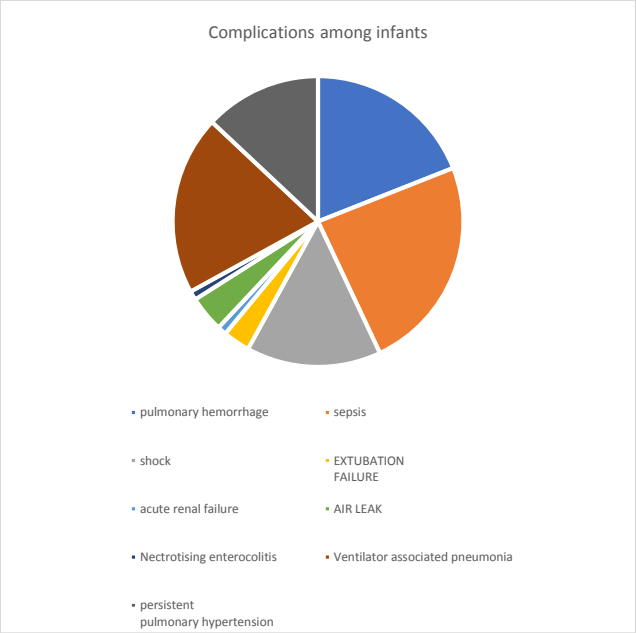
Survival in relation to:	Number of babies (n=60)	Percentage survival
Gender: Male Female	 37 23	 61.7% 38.3%
Birth weight: <1000gram 1000-2500gram >2501gram	 04 40 16	 6.7% 66.6% 26.7%
Gestational age in weeks: 28-36 37-41 >42	 30 28 2	 50.0% 46.7% 3.3%
Downes/Silverman score at admission: < 6 ≥ 7	 43 17	 71.7% 28.3%
Indication: Perinatal asphyxia MAS AOP HMD AOP+HMD	 14 08 15 19 04	 23.3% 13.3% 25% 31.7% 6.7%

Postnatal asphyxia was the most common indication for ventilation in full-term newborns, while HMD was present in preterm infants. The best results were obtained in ventilated infants with MAS, with 100% survival, followed by apnoea in premature infants, perinatal asphyxia, and HMD. The mean gestational age and mean birth weight of the surviving children were significantly higher than that of the expired children, but were not statistically significant. Downes' birth score was not significantly related to the outcome. The pressure requirement during ventilation was much higher in the non-survivors than in the survivors (Table 2).

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

Indicators	Outcome	Number	Mean	SD	P value
PIP mean	survived	46	12.01	1.446	0.003
	death	14	14.20	3.394	0.02
PIP max	survived	46	11.70	1.684	0.001
	death	14	14.98	4.537	0.012
PEEP mean	survived	46	5.01	0.591	0.003
	death	14	5.41	0.378	0.016
PEEP max	survived	46	5.02	0.786	0.001
	death	14	6.97	0.989	0.005
FiO2max	survived	46	75.65	20.374	0.001
	death	14	92.43	9.025	0.001
Respiratory rate mean	survived	46	31.43	3.10	0.003
	death	14	33.85	2.68	0.003
MAP mean	survived	46	7.33	1.80	0.007
	death	14	9.49	2.12	0.007
MAP max	survived	46	8.12	1.81	0.012
	death	14	10.33	3.62	0.029
Ph	survived	12	7.41	0.09	0.000
	death	2	7.01	0.17	0.002

Poor crying, tone of voice, and activity (THA) at birth had a higher mortality rate of more than 54.1% with a p value of <0.05. Indications of ventilation or comorbidities do not have a significant effect on mortality.



Neonates with various complications of ventilation shown in Figure-1

Pulmonary haemorrhage (48.3%) was the most common complication among deceased infants, followed by sepsis (28.3%) and shock (23.4%) with a significant p <0.05. There were no complications in 76.7% of the surviving infants.

DISCUSSION

In our study, HMD was the most communal ventilation indication. In the studies of Riyas et al., Singh et al., Nangia et al. And Karthikeyan et al., This is the most common indication for ventilation[16-17]. Preterm infant apnoea is the next most important indication for ventilation with a 61.5% survival rate in our study. In the study by Ahmed SM et al. It is the most common indication with 22.5% survival. The third most common indication in our study was asphyxia[18]. The 2020 NNPD lists asphyxia at birth as the most common primary cause of neonatal death, with a frequency of 28.8% of all intramural deaths[19]. In our study, the survival rate was 76.7%, which is similar to that observed in various studies, ranging from 41.2% to 67.9%. In this study, the best result was obtained in ventilated neonates with MAS, with 100% survival. MAS had the best result in the series of Malhotra et al. and Riyas et al. with 100% and 63.6% survival, respectively[20]. HMD, the utmost communal ventilation indication in our series, received the fourth best result. Singh et al. And Schreiner et al. Reported better survival in HMD in their studies. In our study, a natural surfactant (of bovine origin) was used selectively as a rescue therapy for infants diagnosed with RDS and in most cases as a delayed rescue. We could not use surfactants prophylactically due to financial constraints. Children with pH> 7.3 had better survival and a significant p-value than children with pH <7.299. This was similar to the observation of Mathur et al. The PIP requirement for the survivors was much higher than for the survivors[21]. Mathur et al. Observed a similar trend in their studies, but the difference was not statistically significant[22].

CONCLUSION

The survival of ventilated infants in this study was 76.7%, and the utmost communal sign for ventilation was HMD. Among the many common variables of the subjects, the pressure requirement during ventilation was significantly higher in the survivors than in the survivors. The presence of pulmonary haemorrhage and sepsis heralded a poor prognosis. Early diagnosis of respiratory

complications, frequent monitoring, and good nursing care are key to successful weaning.

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