OUTCOME OF NEONATES VENTILATED IN NICU OF A TERTIARY CARE HOSPITAL AND FACTORS ASSOCIATED WITH POOR OUTCOME

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ABSTRACT

Objective: To ascertain the outcome of neonates who are ventilated for various reasons in our Neonatal Intensive Care Unit (NICU) and determine the risk factors associated with increased incidence of adverse outcome.
Study Design: Retrospective study.
Place and Duration of Study: Neonatal Intensive Care Unit of Combined Military Hospital Rawalpindi from Jul 2016 to Dec 2016.
Material and Methods: All neonates who received mechanical ventilation during the study period were included in the study.
Results: Total sixty seven (35.8% females and 64.15% males) neonates were ventilated during the study period for various reasons. Of these 67 neonates who were ventilated, 35 (52.23%) died and 32 (47.76%) survived to be discharged home. 10 babies were born less than 28+ 0weeks gestation and all (100%) expired. Of 7 babies born between 28^{+1}-31^{+6} weeks gestation, only 01 (14.28%) survived. Of 50 newborns between 32^{+0}-36^{+6} weeks, 20 (40%) died and 30 (60%) survived to be discharged home.
In our cohort of ventilated babies, 7 weighed less than 1000 gm of which 6 (85.71%) died and only 01 (14.28%) survived. Of 18 babies born 1000-1499 gm, 14 (77.77%) died and 4 (22.22%) survived. Of 14 babies born between 1500-2499 gm, 6 (42.85%) died and 8 (57.14%) survived. Of all ventilated babies, 28 weighed more than 2500 gm, of which 10 (35.71%) died and 18 (64.28%) survived.
Out of our cohort of 67 babies, 14 were diagnosed with hypoxic ischemic encephalopathy grade 3, of which 11 (78.57%) died and 3 (21.42%) were discharged. Twenty three had RDS, of which 11 (47.82%) died and 12 (52.17%) survived. Ten babies were ventilated due to sepsis, of which 6 (60%) died and 4 (40%) survived.
Conclusion: We conclude that gestational age less than 32^{+0} weeks, birth weight less than 1500 gm, Hypoxic Ischemic Encephalopathy grade 3 and sepsis are associated with a poor outcome in babies who are mechanically ventilated.

Keywords: Mechanical ventilation, Neonates, NICU, HIE, RDS, Sepsis, Pakistan.

INTRODUCTION

Worldwide more than 6 million children die before reaching their 5th birthday and out of these more than half children die within one month[1]. The death of a baby in the first 28 days of life is called as neonatal mortality[2]. Two thirds of the neonatal mortality occurs in ten countries of the world, most of which are from Asia and Africa[3]. At present, Pakistan is at number 26 as far as under-5 mortality rate is concerned and it is also a very sad fact that Pakistan heads the list as far as neonatal mortality rate is concerned. The neonatal mortality rate of Pakistan is 55/1000 live births, which contribute 7% to the global neonatal mortality rate. Many factors contribute to this high neonatal mortality rate but the major causes worldwide are sepsis, pre maturity and birth asphyxia, all three of which account for 87% of the neonatal mortality[4-8].

With the improvement in health care and the education of masses more deliveries are now being conducted at hospitals and so more critically ill neonates are reaching the intensive care units[9]. A large number of neonates admitted to NICUs require mechanical ventilation. Of those ventilated we have no data about the outcome of those babies. In developed countries,

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64%-68% of those mechanically ventilated survive to discharge[10,11]. However in developing countries, the situation is not encouraging where the mortality ranges from 40-60%[12, 13].

The prime responsibility of a neonatologist is to reduce the neonatal mortality and reduce the neonatal morbidity. In order to accomplish this job, it is important to know the factors which are associated with high neonatal mortality. Though mechanical ventilation is widely used in many developing countries including Pakistan, we do not have any published data on the survival of these babies along with factors inferring its outcome. This study was designed to know the outcome of neonates ventilated in our set up and analyze the factors associated with poor outcome. We analyzed different factors in neonates who were put on mechanical ventilation for various reasons and tried to find out a correlation with the outcome in these babies.

PATIENTS AND METHODS

This retrospective study was carried out in the neonatal intensive care unit (NICU) of Combined Military Hospital, Rawalpindi from January 2016 to December 2016. This hospital receives newborns delivered indoor as well as outdoor. Hospital records revealed that during the study period, total 67 neonates (age range 0-28 days) were consecutively intubated and put on mechanical ventilation. Neonates with major congenital malformations like congenital heart disease, dysmorphic babies and those suspected of having a metabolic disorder were excluded from the study. Also neonates who were received from outdoor health care facilities as well as post-surgical babies were excluded from the study. All the remaining newborns that were put on mechanical ventilation were included in the study.

The indications for putting a baby on mechanical ventilation included gasping or poor respiratory effort, oxygen saturation of less than 88% despite supplemental oxygen through non invasive techniques, recurrent episodes of apnea and findings on capillary blood gases consistent with type 2 respiratory failure (PaO^2 less than 50 mmHg along with a PaCO2 levels of more than 60 mmHg). The general parameters used for majority of the neonates were: Tidal volume (Vt) 6–10 ml/kg, positive end-expiratory pressure (PEEP) 4-8 mmHg, peak inspiratory pressure (PIP) 18-28 mmHg, inspiratory time 0.25-0.5 s, and FiO2 0.40–0.80. The facility for high frequency oscillatory ventilation (HFOV) is available in our NCIU and used in babies where indicated. The neonates were initially put on assist control mode of ventilation and synchronized intermittent mandatory mode was the main weaning mode in our neonates. Pressure limited ventilation was used and babies were regularly assessed clinically round the clock and 12 hourly by the consultant neonatologist and earlier if required. Capillary blood gases and chest x-rays were done according to the unit protocol and ventilator settings changed according to the x-ray findings and the capillary blood gases report. Other investigations like complete blood count, C- reactive protein, liver and renal function tests, blood cultures, cerebrospinal fluid examination and other investigations were done as and when required. Whenever we place a neonate on mechanical ventilation, the parents or caregivers are informed about reason for putting the baby on mechanical ventilation as well as possible outcome. Informed written consent was taken from parents/caregivers of all neonates who were included in the study. Permission was sought from hospital ethical committee.

For every baby who was put on mechanical ventilation, data including age, gender, gestation, any maternal illness, any use of drugs by the mother during pregnancy, birth weight, mode of delivery, requirement of resuscitation at the time of delivery, reasons for ventilation, a presumed diagnosis and complications were tabulated from the hospital data records. The data was recorded on Microsoft Excel Sheet and analyzed through SPSS version 20. Categorical variables were presented as percentages and frequencies.

RESULTS

During the study period, total 67 neonates, who fulfilled the inclusion and exclusion criteria and who were put on mechanical ventilation, in our NICU were included in the study. Of these 24 (35.8%) were females and 43 (64.15%) were males. Mean weight and gestational age were 2070 ± 890gm and 32.8 ± 5.4 weeks respectively. 45 neonates were delivered via LSCS and 22 were born via Spontaneous Vaginal Delivery. Of the total 67 neonates who were ventilated in our study, 35 (52.23%) died and 32 (47.76%) survived and discharged home.

Of 10 babies born less than 28^{+0} weeks gestation, all 10 (100%) died. Of these 10 babies, 9 weighed less than 1500 gm and only one baby weighrd between 1500-2499 gm. Six babies developed RDS, 3 were having HIE, and one baby had a primary diagnosis of sepsis.

Of 7 babies born between 28^{+1}-31^{+6} weeks gestation, only 02 (28.57%) survived and 5 (71.42%) died. Further breakdown revealed, 01 baby had a birth weight less than 1000 gm, 01 was between 1500-2499 gms while remaining 5 were having birth weight of 1000-1499 gms. One out of these 7 babies was having sepsis, 03 had HIE while 03 were having RDS as shown in table.

Total of 50 newborns were born at 32^{+1}-36^{+6} weeks. Of which 20 (40%) died and 30 (60%) survived to discharge home. Of these, 2 were less than 1000 gm, 09 were having birth weight of 1000-1499 gms, 12 were between 1500-2499 gms while 27 newborns were more than 2500 gms. Of these 50 newborns, 11 had HIE, 09 had meconium aspiration, 09 were diagnosed to have neonatal sepsis, 20 developed RDS, while one neonate was labeled as having TTN.

In our study, 7 babies were less than 1000gm weight at birth, of whom 6 (85.71%) died and only 01 (14.28%) survived. Eighteen babies were born having birth weight of 1000-1499 gms and out of these 14 (77.77%) died and 4 (22.22%) survived. While 14 babies were born between 1500-2499 gms and out of these 6 (42.85%) died and 8 (57.14%) survived. Twenty eight babies were having birth weight more than 2500 gms and out of these 9 (32.14%) died and 19 (67.85%) survived (table).

Out of the 67 babies, 16 (23.88%) were diagnosed to have HIE, of whom 13 (81.25%) died and 3 (18.75%) were discharged home. Twenty nine (43.28%) babies were having RDS out of which, twelve (41.37%) died and 17(58.6%) survived. Sepsis was found in twelve (17.91%) babies out of whom seven (58.33%) died and five (41.66%) survived. Nine (13.43%) had meconium aspiration of which six (66.66%) survived and three (33.33%) died (table). One newborn was labeled to have TTN and he survived and discharged home.

Table: Outcome of babies with respect to birth weight.

Weight	Outcome		Total
	Died	Discharged	
<1000 gm	6	01	7
>2500gms	9	19	28
1000-1499 gms	14	4	18
1500-2499 gms	6	8	14
Total	35	32	67

DISCUSSION

Experience with regard to neonatal mortality among newborns who receive mechanical ventilation has not been published so far in Pakistan. Our search of the internet did not give us a single article focused on the neonatal mortality among babies who receive mechanical ventilation.

Neonatal mortality among newborns admitted to NICU is very high when compared to any other age group[14,15] but this mortality rate is

even higher among those who receive mechanical ventilation. In our study, mortality was 52.23% which is comparable to mortality rates reported by Nidhi et al[16] and Sangeeta et al[17] the West achieved this success rate in the 1980s 18 and currently the mortality rates in developed countries is less than 10%[19]. H. Trotman[10], Hossain et al[9] and Mathur et al[20] reported figures of 36%, 70.6% and 74% respectively. The differences in mortality rates of ventilated neonates among developed and developing countries may be related to the ready availability of surfactant and total parenteral nutrition in developed countries as compared to developing countries. Limited technical expertise, lack of skilled manpower and technological advances in developing countries may also be an added factor.

Gender and age at admission did not have a significant association with the outcome as was found by Riyas et al[12] and Kollef et al[21] However neonatal mortality is affected by the birth weight and gestational age of the neonate. This has been shown in many studies[9,19].

The most common indication for ventilation in our study was Respiratory distress syndrome (RDS), accounting for 43.28% of total admissions. This finding is similar to other studies[13,22]. The survival rate in babies having RDS was 65.38% which is comparatively higher as reported by Singh et al[23]. The improved survival rate in our babies was probably related to the timely administration of surfactant to all the babies and the liberal use of ante natal steroids to the mothers. The non-survivors in this group were noted to be the smaller, and premature. This association of low birthweight and prematurity with poor survival has been documented in many other studies[12,13]. The survival of infants with RDS increases with increase in gestational age and increase in birth weight[24,25]. This was also found in our study. Neonates whose birth weight was less than 1.5 kg and who were less than 28 weeks of gestation had less survival as compares to those who were more than 1.5 kg birth weight and more than 32 weeks gestation.

Other indications of neonatal mechanical ventilation in our studies were birth asphyxia (23.88%), sepsis (17.91%), meconium aspiration syndrome (13.43%) and transient tachypnea of the newborn.

The main limitation of our study was its sample size. Due to the small sample size, these results cannot be generalized to the whole population. However, since this was a pilot study and no such study has ever been conducted so far in Pakistan, large clinical studies are needed in multiple centers in order to determine the exact factors associated with poor outcome in babies receiving mechanical ventilation. The second limitation of this study was that we focused only on those babies who received mechanical ventilation. We did not focus on babies who received non invasive forms of ventilation like the CPAP.

CONCLUSION

We concluded from our study that the outcome was poor for those babies whose birth weight was less than 1500 grams and gestational age was less than 32 weeks.

RECOMMENDATION

Our data suggests that mechanical ventilation should be focused on those weighing more than 1500 gms and gestational age of more than 32 weeks because of their better survival rate. Babies less than 1500 grams and less than 32 weeks gestation should be provided with extra care and monitoring including one-on-one nursing care. Babies with severe birth asphyxia and those with meconium aspiration syndrome may also require stringent criteria for ventilator support owing to their poor survival and long term sequelae.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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