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MORBIDITY AND MORTALITY OF EXTREMELY LOW BIRTH WEIGHT BABIES IN A TERTIARY CARE CENTRE IN EASTERN INDIA

Neonatology

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ABSTRACT

***Background*:** Being born preterm increases the risk of both morbidity and mortality but with improved care the chances of survival is increasing. The age of viability was earlier defined at 28weeks but in the best of centres it has now come down to 25weeks. Extremely low birth weight (ELBW) babies who weigh less than 1000gms are particularly at risk of dying with the overall mortality in this group ranging from 30% to 50 % in the best of centres. This study was conducted to find out the immediate outcome of extremely low birth weight babies born in a tertiary care centre, of a resource poor country like India.

***Objective*:** To evaluate the immediate morbidity and mortality of Extremely Low Birth Weight Babies in the NICU setup of a tertiary care hospital.

***Study Design*:** Retrospective Observational Cohort Study

***Place of Study*:** Department of Paediatrics, Ramakrishna Mission Seva Pratishthan, Vivekananda Institute of Medical Sciences, Kolkata, India

***Period of Study*:** January 2018 to December 2020

***Methods*:** The study was a retrospective analysis of data of babies born with a birth weight of less than 1000gms and admitted to the Neonatal Intensive care unit of Ramakrishna Mission Seva Pratishthan. The maternal demographic profile and delivery outcome were recorded along with the neonatal morbidity and mortality in a predesigned proforma. These data were then pooled and analysed.

***Results*:** The total number of ELBW babies born during this period was 31 out of whom 15 succumbed(48%). The studies in the developed world too shows the mortality in this group to range between 30 to 50 %. Most of the deaths occurred in the first few days of life due to birth asphyxia. The commonest morbidity was Respiratory Distress Syndrome (RDS) (71%), followed by sepsis (64.5%), anemia (54.8%) and hyperbilirubinemia (51.6%). Necrotising Enterocolitis (NEC) was found in 9.7% of babies. 16 babies (52%) survived and went home in a stable condition. Retinopathy Of Prematurity (ROP) was detected in 11 of these babies for whom laser therapy was done with the advise for follow up.

***Conclusion*:** This study shows that in a resource poor country like India too, the percentage of babies who can be salvaged amongst the extremely low birth weight babies, matches with those in the developed countries, though a question remains about their long term morbidity.

KEYWORDS

ELBW babies. Morbidity. Mortality, Outcome, Viability

INTRODUCTION

An extremely low birth weight (ELBW) infant is defined as one with a birth weight of less than 1000 gms. Increasing survival among extremely preterm infants has focused more attention on these babies, who are smaller in birth weight and lower in gestational age. Technological and therapeutic advances have improved during the past 2 decades, increasing survival among the smallest, most immature infants (1). ELBW survival has improved with the widespread use of exogenous surfactant agents, maternal steroids and advancements in neonatal technologies. Human viability, defined as gestational age at which the chance of survival is 50%, is currently approximately 23 to 24 weeks in developed countries(2). Although the mortality rate has greatly diminished with the use of surfactants, the proportion of surviving infants with severe sequelae, such as chronic lung disease, cognitive delays, cerebral palsy, and neurosensory deficits (ie, deafness and blindness), has not decreased significantly. The outcome of these ELBW babies depend on the level of care they receive. This study was conducted to evaluate the immediate morbidity and mortality of this group of babies in the neonatal intensive care unit of a tertiary care centre in East India.

MATERIALS AND METHODS

Place of Study:

Department of Paediatrics, Ramakrishna Mission Seva Pratishthan, Vivekananda Institute of Medical Sciences, Kolkata, India

Period of Study:

January 2018 to December 2020

INCLUSION CRITERIA:

All Live babies born with a birth weight of less than 1000gms

EXCLUSION CRITERIA:

1. Babies born before 24 weeks and non viable
2. Babies born with gross congenital anomaly
3. Out born babies

Procedure of Methodology

The study was a retrospective analysis of data, of babies born with a birth weight of less than 1000gms and admitted to the Neonatal Intensive care unit of Ramakrishna Mission Seva Pratishthan. This hospital is a charitable hospital catering to low and medium socioeconomic strata and all the mothers are booked and receive regular antenatal checkup. The case sheets of mothers and babies were studied and data was collected in a predesigned proforma. The antenatal history, maternal age, parity, presence of any obstetrics or medical complication and whether antenatal steroids was given or not was noted. The mode of delivery, birth weight, resuscitation efforts and immediate post natal management was recorded along with details of NICU stay. The duration of CPAP, Mechanical Ventilation, surfactant use and the various neonatal complication that occurred during this period was documented. The feeding details, weight gain and the final outcome was also noted and these data was compiled and analysed statistically. Gestational age was assessed by gestational ultrasound and Ballard scoring, while birth weight was measured on Martin Electronic weighing scale.

STATISTICALANALYSIS:

Data were coded and recorded in MS Excel. SPSS v23 (IBM Corp.) was used for data analysis. Means/standard deviations and medians/IQRs were used for continuous variables and frequencies and percentages for categorical variables. Data were presented in a graphical manner wherever appropriate. Group comparisons for continuously distributed data were made using independent sample 't' test when comparing two groups. If data were found to be non-normally distributed, appropriate non-parametric tests in the form of Wilcoxon Test were used. Chi-squared test was used for group comparisons for categorical data. In case the expected frequency in the contingency tables was found to be <5 for >25% of the cells, Fisher's Exact test was used instead. Linear correlation between two continuous variables was explored using Pearson's correlation (if the data were normally distributed) and Spearman's correlation (for non-normally distributed data). Statistical significance was kept at $p < 0.05$.

RESULTS

Thirtyone babies were admitted with a birth weight of less than 1000

grams between January of 2018 to December of 2020 in the neonatal intensive care unit, of which 11 (35.5%) were below 750gms while 20 (64.5%) weighed between 751 and 1000gms and the smallest baby weighed as less as 480gms. Table 1 shows the summary of maternal and neonatal characteristics. The mean Gestational Age (Weeks) was 27.68 ± 2.29, the youngest being born at 24 weeks. The mean maternal age was 26.7 and majority (74.2%) were primipara. There was history of premature rupture of membranes in 16.1% and 3 mothers had pregnancy induced hypertension. Only 25.8 % received antenatal steroids as most of the mothers came in labour. 20 (64.5%) of the babies were delivered vaginally whereas 11 (35.5%) of them were delivered by LSCS. The male to female ratio was 0.82 as there were 14 male and 17 female babies.

Table 1: Summary of Maternal and Neonatal Details

Clinical Details	Mean ± SD || Median (IQR) || Min-Max || Frequency (%)
Maternal Age (Years)	26.77 ± 3.77 || 26.00 (24.00-29.00) || 19.00 - 35.00
Maternal Age	
18-25 Years	12 (38.7%)
26-30 Years	13 (41.9%)
31-35 Years	6 (19.4%)
Parity	
P0	23 (74.2%)
P1+	8 (25.8%)
Gestational Age (Weeks)	27.68 ± 2.29 || 27.00 (26.00-29.00) || 24.00 - 34.00
Antenatal Steroids (Yes)	8 (25.8%)
H/O PROM (Yes)	5 (16.1%)
Mode Of Delivery	
Vaginal	20 (64.5%)
LSCS	11 (35.5%)
Birth weight (grams) Birth Weight	786.29 ± 132.40 || 800.00 (690.00-887.50) || 480.00 - 990.00
≤750 grams	11 (35.5%)
>750 grams	20 (64.5%)

Table 2: Distribution of the Participants in Terms of Gestational Age (Weeks) (n = 31)

Gestational Age (Weeks)	
Mean (SD)	27.68 (2.29)
Median (IQR)	27 (26-29)
Range	24 - 34

The variable Gestational Age (Weeks) was not normally distributed (Shapiro-Wilk Test: p = 0.036). The mean (SD) of Gestational Age (Weeks) was 27.68 (2.29) , with a range of 24-34 weeks

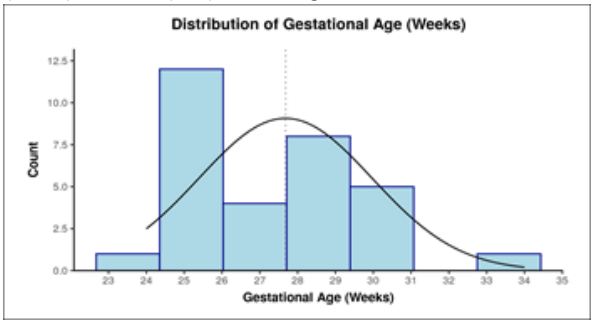


Table 3: Distribution of the Participants in Terms of Birth Weight (grams) (n = 31)

Birth Weight (grams)	
Mean (SD)	786.29 (132.40)
Median (IQR)	800 (690-887.5)
Range	480 - 990

The variable Birth Weight (grams) was normally distributed (Shapiro-Wilk Test: p = 0.369).

The mean (SD) of Birth Weight (grams) was 786.29 (132.40). The Birth Weight (grams) ranged from 480 - 990.

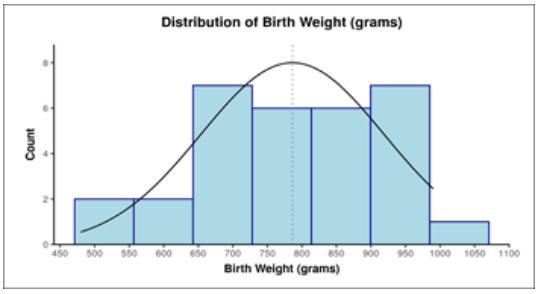


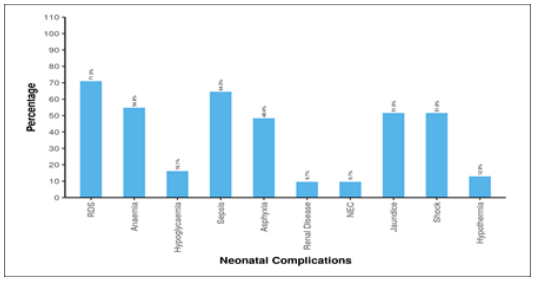
Table 4: Distribution of the Participants in Terms of Baby Gender (n = 31)

Baby Gender	Frequency	Percentage
Male	14	45.2%
Female	17	54.8%
Total	31	100.0%

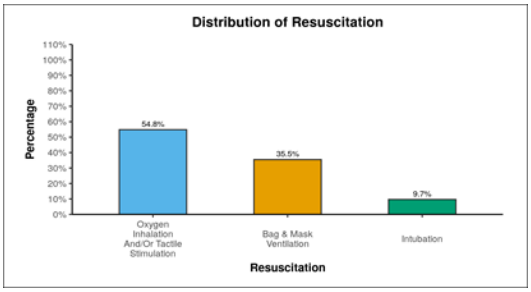
45.2% of the participants were Male, and 54.8% were Female.

Table 5: Summary of Neonatal Complications

Neonatal Complications	Yes	No
RDS	22 (71.0%)	9 (29.0%)
Anaemia	17 (54.8%)	14 (45.2%)
Hypoglycaemia	5 (16.1%)	26 (83.9%)
Sepsis	20 (64.5%)	11 (35.5%)
Asphyxia	15 (48.4%)	16 (51.6%)
Renal Disease	3 (9.7%)	28 (90.3%)
NEC	3 (9.7%)	28 (90.3%)
Jaundice	16 (51.6%)	15 (48.4%)
Shock	16 (51.6%)	15 (48.4%)
Hypothermia	4 (12.9%)	27 (87.1%)



RDS, Sepsis, hyperbilirubinaemia and shock accounted for the highest number of complications, occuring in 71%, 64.5 %, 51.6% , and 51.6 % of the babies respectively. Anaemia was present in 54.8% of the newborns, and 48.4% had birth asphyxia. Hypoglycaemia was documented in 16.1% of the babies. A special concern, hypothermia occurred in 12.9%. Renal disease in 9.7% and necrotising enterocolitis in 9.7% also complicated the course for some of the preterm infants .



Some form of resuscitation was provided to all the babies. 54.8% were given inhaled oxygen at delivery, with or without tactile stimulation, and they required no further resuscitative measures. 35.5% needed bag and mask ventilation and 9.7% had to be intubated before being transferred to the NICU.

Table 6: Summary of Surfactant, CPAP and ventilation requirements

Surfactant	Mean ± SD || Median (IQR) || Min-Max || Frequency (%)
Requirement in	21 (67.7%)

Administration (Hours After Birth)	4.93 ± 5.09 || 5.00 (1.00-6.00) || 0.50 - 21.00
CPAP	
Requirement in	22 (71.0%)
Duration (Days)	6.81 ± 5.36 || 6.00 (4.00-7.00) || 0.50 - 22.00
Ventilation	
Requirement in	23 (79.3%)
Duration (Days)	3.52 ± 3.68 || 2.00 (1.00-4.00) || 1.00 - 17.00

Out of 31 babies, 21 (67.7 %) received surfactant . Surfactant was administered an average of 4.93 hours after birth with the time ranging from half an hour to 21 hours after birth.

71% were given CPAP . The mean duration that the babies received CPAP was 6.81 ± 5.36 days.

79.3% went on to require mechanical ventilation. The mean duration of ventilation in these babies was 3.52 ± 3.68 days.

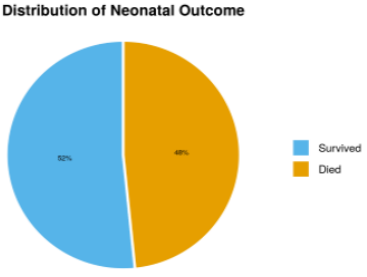
Table 7: Distribution of the Participants in Terms of Duration Of NICU Stay (Days) (n = 31)

Duration Of NICU Stay (Days)	
Mean (SD)	31.52 (30.20)
Median (IQR)	29 (2-58)
Range	1 - 90

The variable Duration Of NICU Stay (Days) was not normally distributed (Shapiro-Wilk Test: p = 0.001). The mean (SD) of Duration Of NICU Stay (Days) was 31.52 (30.20). The median (IQR) of Duration Of NICU Stay (Days) was 29.00 (2-58). The Duration Of NICU Stay (Days) ranged from 1 - 90.

Table 8: Distribution of the Participants in Terms of Neonatal Outcome (n = 31)

Neonatal Outcome	Frequency	Percentage
Survived	16	51.6%
Died	15	48.4%
Total	31	100.0%



Out of all the babies included in the study, 52% survived . 48% could not be saved.

Table 9: Association between Neonatal Outcome and Parameters

Parameters	Neonatal Outcome		p value
	Survived (n = 16)	Died (n = 15)	
Gestational Age (Weeks)	27.94 ± 2.14	27.40 ± 2.47	0.314[3]
Antenatal Steroids (Yes)	5 (62.5%)	3 (37.5%)	0.685[2]
H/O PROM (Yes)	4 (80.0%)	1 (20.0%)	0.333[2]
Baby Gender			0.576[4]
Male	8 (57.1%)	6 (42.9%)	
Female	8 (47.1%)	9 (52.9%)	
Mode Of Delivery			0.081[4]
Vaginal	8 (40.0%)	12 (60.0%)	
LSCS	8 (72.7%)	3 (27.3%)	
Birth Weight (grams)	827.50 ± 117.87	742.33 ± 136.62	0.075[1]
Birth Weight			0.611[4]
≤750 grams	5 (45.5%)	6 (54.5%)	
>750 grams	11 (55.0%)	9 (45.0%)	
Duration Of NICU Stay (Days)	55.56 ± 22.05	5.87 ± 8.23	<0.001[3]
RDS	14 (63.6%)	8 (36.4%)	0.054[2]
Neonatal Hypoglycaemia	2 (40.0%)	3 (60.0%)	0.654[2]
Neonatal Sepsis	14 (70.0%)	6 (30.0%)	0.006[4]
Neonatal Asphyxia	3 (20.0%)	12 (80.0%)	<0.001[4]
Necrotising enterocolitis	2 (66.7%)	1 (33.3%)	1.000[2]
Shock	1 (6.2%)	15 (93.8%)	<0.001[4]
Hypothermia	0 (0.0%)	4 (100.0%)	0.043[2]
Resuscitation* **			0.005[2]
Oxygen Inhalation And /Or Tactile Stimulation	13 (76.5%)	.4 (23.5%)	
Bag & Mask Ventilation	3 (27.3%)	8 (72.7%)	
Intubation	0 (0.0%)	3 (100.0%)	
Surfactant: Requirement (Yes)	10 (47.6%)	11 (52.4%)	0.704[2]
Surfactant: Administration (Hours After Birth)	3.45 ± 3.64	6.27 ± 5.98	0.171[3]
CPAP: given in	15 (68.2%)	7 (31.8%)	0.006[2]
CPAP: Duration (Days)	7.82 ± 5.99	4.79 ± 3.29	0.524[3]
Ventilation: Requirement	8 (34.8%)	15 (65.2%)	0.006[2]
Ventilation: Duration	5.88 ± 4.91	2.27 ± 2.09	0.013[3]

****Significant at p<0.05, 1: t-test, 2: Fisher's Exact Test, 3: Wilcoxon-Mann-Whitney U Test, 4: Chi-Squared Test*

The following variables were significantly associated (p<0.05) with the Neonatal Outcome in terms of survival: duration of NICU stay, neonatal complications like sepsis, asphyxia, hypoglycaemia, shock and hypothermia.

57.1% of the male babies survived, however, only 47.1% of the females survived.

Caesarean deliveries were associated with survival of 72.7 % of the babies, whereas 40% of babies born vaginally survived. The babies who survived spent an average of 55.5 days in the NICU, whereas the ones who died were in the NICU for an average of 5.87 days.

Birth asphyxia, shock and hypothermia were the main determinants of mortality as 80%, 93.6%, and 100% respectively of the babies who had these complications died.

100% of the babies whose asphyxia was severe enough to require intubation at birth could not be saved. Among the babies who survived, the average timing of surfactant was 3.45 hours, as compared to 6.27 hours in the group of non- survivors.

DISCUSSION:

Preterm birth rates have increased overall as a result of a variety of factors, including increases in elective early Cesarean deliveries, multiple births, advanced maternal age, and complications of pregnancy (3). Viability of a fetus means that it has reached such a stage of development so as to be capable of living, under normal conditions, outside the uterus. Viability exists as a function of biomedical and technological capacities, which are different in different parts of the world(4). Earlier, the gestational age for viability was defined at 28weeks but with the advancement of preterm care in neonatal intensive care units, it is now possible to salvage babies as young as 25 weeks. In a study by I. Macedo et al in Lisbon, Portugal in the year 2000, found that at 25 weeks, mortality was 44.4% and at 26 weeks it was 24.4% . The American Academy of Pediatrics/ American Health Academy's 2015 resuscitation guidelines takes 25 weeks' gestation as a cut-off point(5).

The total number of births in our hospital during the study period was 8684 and the percentage of ELBW babies was 0.357. In a study by Bhimwal RK et al, incidence of extreme low birth weight babies was 0.89% (6).

Extremely low birth weight infant (<1000 g) remain at high risk for death and disability with 30% to 50% mortality and in survivors, at least 20% to 50% risk of morbidity (7). In our study the mortality was 48.3%, and most of the deaths occurred in the first 2-3 days of life due to birth asphyxia. In a study by W Meadow et al found that 80% of

deaths in ELBW babies occurred in the first 3 days of life. (8) Most of the studies in the developed countries showed that the rate of mortality varied from 33.5% to 49% in ELBW babies post surfactant. (9)

A systematic review of prediction models by Stephanie et al concluded that multivariate models can predict mortality better than birth weight or gestational age alone (9). In our study too the mortality was not significantly associated with either birth weight (p value 0.61) or gestational age (p value 0.31).

The commonest morbidity was Respiratory Distress Syndrome (RDS) even though 21 out of 31 (67.7 %) of them received surfactant . Surfactant was administered an average of 4.93 hours after birth . Sepsis is the commonest cause of neonatal mortality; it is responsible for about 30-50% of the total neonatal deaths in developing countries (10). In our study 20 babies (64.5%) were diagnosed to have sepsis, out of whom 6 died (30%).

The 16 babies who survived the initial complications, gradually stabilized and were fed with expressed breast milk and almost all babies required human milk fortifier to maintain adequate growth. The babies were gradually put to mother's breast along with Kangaroo Mother Care (KMC). Multivitamins, Calcium and iron were started at the appropriate time. The mean duration of hospital stay was 55.5 days. Retinopathy Of Prematurity (ROP) was detected in 11 of them for which they underwent laser therapy with further advice for follow up in the Eye OPD. OAE was done in all babies with advice for a follow up BERA. The weight at discharge was satisfactory and the parents were counselled regarding care of the newborn at home.

Limitation of this study was that the sample size was small and long term morbidity of the discharged babies was not done but it is our endeavour to do so in future.

CONCLUSION

Intact survival of ELBW babies is always our endevour but they pose multiple challenges requiring prolonged hospital stay with associated high cost of therapy. Our hospital being a charitable institution, NICU bed charges are free with minimum cost for investigations. This study showed that more than 50% of them survived and went home in a stable condition even in a resource poor country like India. So with ethical and medicolegal implications of decision making, we should make our best efforts to follow all the necessary protocols to help salvage these babies.

Contributions:

Dr.Neena Ghose (NG) Orcid id- 0000-0002-1334-3016
Dr Sumita Basu (SB) Orcid id- 0000-0001-5477-6750

NG and SB enrolled the babies for the study, collected and analysed the data; NG wrote the initial draft and SB revised it critically. SB conceived, designed and supervised the study. All authors approved the final manuscript.

Dr Sumita Basu will be the corresponding author (email id- sumitabs@yahoo.com)

Compliance with Ethical Standards
Conflict of Interest None
Source of funding None

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