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Mortality and Morbidity Profile of Low Birth Weight Babies ata Tertiary Care Hospital

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Abstract:
Introduction: *Mortality and morbidity are highest in low birth weight babies who constitute approximately 25% of all live births in India.*
Aims*: To compute the rate and determine the determinants of mortality and morbidity of low birth weight babies at a medical college hospital.*
Methodology: *Data of LBW babies (≤2000 grams) admitted to the department of neonatology over a period of 30 days like condition of the baby at admission along with the relevant lab investigations, type of delivery and morbid conditions were noted. Birth weight, gestational age, risk factors (RF), length of hospital stay and out come at discharge were collected and retrospective analysis was done.*
Results*: Out of 91 cases (M: F=1.9:1) preterm vs. term were 69(75.8%) and 22(24.2%). 39 (42.9%) neonates were LBW, 22 (24.2%) VLBW (≤ 1500 grams)and11(12.1%) ELBW (≤ 1000 grams). 19 neonates were SGA (20.9%). There is correlation between morbid conditions and birth weight (r = 100.912, p= 0.0001). Prognosis was worse in VLBW babies and worst in ELBW babies. (p value=0.00009). Babies appropriate for gestational age showed good prognosis in comparison to SGA babies (p=0.03). Multivariate analysis showed that neither the sex of infant (p-Value = 0.971) nor the mode of delivery (p=0.51) influence mortality. As the number of RF increase (1,2, >2) prognosis becomes worse (p= 0.0000036).*
Conclusion*: Major determinants for mortality in LBW babies were birth weight in grams, no. of risk factors and respiratory rate at the time of admission but not sex of the baby or mode of delivery.*
Key Words:*Morbidity, Mortality, LBW, SGA*

I. Introduction

Low Birth Weight (LBW) according to WHO is defined as the birth weight of a live born infant less than 2,500 grams (5.5 pounds) regardless of gestational age. Subcategories include Very Low Birth Weight (VLBW), in which birth weight is less than 1500 grams, and Extremely Low Birth Weight (ELBW), in which birth weight is less than 1000 grams. The definition helps in identifying neonates who require special care. Despite the apparent importance of LBW as an indicator, there have been few prospective studies to determine the outcome for LBW infants in developing countries, largely because of the difficulties inherited in community-based data collection [1]. The definition of LBW also fails to distinguish between LBW neonates who are premature and those who are merely small for their gestational age. As a result, there is a lack of information about infant mortality in the first four weeks of life, and this has hindered the development of appropriate neonatal interventions [1]. In developing countries like India adoption of this standard weight would lead to high incidence of LBW neonates and many of them do not require special care. Hence a cut off birth weight of ≤ 2000 grams was taken as LBW.

Newborn deaths account for 40% of all deaths among children under five. Perinatal mortality is six times higher in LBW babies. 75% of neonatal deaths occur during the first week of life, and between 25% to 45% occur within the first 24 hours [2]. The main causes of newborn deaths are prematurity and low-birth-weight, infections, asphyxia, meconium aspiration syndrome, respiratory distress syndrome, birth trauma. These causes account for nearly 80% of neonatal deaths.

Much of the recent decline in neonatal mortality can be attributed to increased survival among low-birth-weight infants, apparently as a result of hospital and community based services. Despite increased access to antenatal services, only moderate declines in the proportion of low-birth-weight infants has been observed, and almost no change has occurred in the proportion of those with very low weight at birth. In addition, in many areas of the country the birth-weight-specific neonatal mortality rates are similar for groups at high and low risk of neonatal death. In view of these findings, continuation of the current decline in neonatal mortality and

morbidity require the identification and more effective implementation of strategies for the prevention of low-weight births and also focusing on core problem areas as on today.

Aims

To compute the rate and determine the determinants of mortality and morbidity of babies weighing ≤ 2000 grams at birth admitted into a neonatal/pediatric tertiary care center in South India.

II. Methodology

We retrospectively analyzed the case sheets of babies admitted over a period of 30 days in the department of Neonatology at our center after getting the Local Institutional Ethics Committee approval. Birth weight of the baby, gestational age, risk factors (if any), reason for admission, length of hospital stay and out come at the end of hospital stay were noted. Clinically heart rate (HR), respiratory rate (RR) and general condition of the baby at admission and throughout the hospital stay were noted. Relevant Lab investigations like hemoglobin (Hb %), sepsis screen, platelet count (PC), random blood sugar (RBS), serum bilirubin etc. were noted.

Depending on the birth weight neonates were classified into Low birth weight (LBW ≤ 2000 gm.), Very low birth weight (VLBW≤1500 gm.) and extremely low birth weight (ELBW ≤1000 grams). Neonates who were small for gestational age (SGA) were also identified.

Risk factors (both maternal and fetal) for fetal mortality and morbidity like multiple gestation, pregnancy induced hypertension (preeclampsia and eclampsia), Gestational diabetes, Meconium stained liqour (MSL), premature rupture of membranes (PROM), prolonged labour, oligohydramnios, intrauterine growth retardation (IUGR), delayed cry, Meconium aspiration syndrome (MAS) were noted.

Correlation between mortality of the neonatesand different parameters like mode of delivery, birth weight, risk factors, gestational age, length of stay, HR, RR, Hb%, TLC, PC, RBS were studied. Morbid conditions during the hospital course or at the time of discharge if any were noted.

Analysis

Pearson Chi-Square test, univariate analysis, general regression analysiswere used for analysis.

III. Results

We analyzed 250 consecutive cases admittedover 30 days of which 91 were ≤2000 grams (M: F::1.9:1). Preterm babies were 69(75.8%). 39 (42.8%) neonates were LBW, 22 (24.2%) were VLBW and 11(12.1%) were ELBW.19 neonates were SGA (TABLE 1 & 2).

Table 1: Stratification of Babies based on birth weight.

BIRTH WEIGHT	TOTAL NO.OF BABIES (91)	
	NUMBER	PERCENTAGE (%)
LBW (1500-2000 gm.)	39	42.8
VLBW (1000-1499 gm.)	22	24.2
ELBW (0-999 gm.)	11	12.1
SGA (0-2000 gm.)	19	20.9

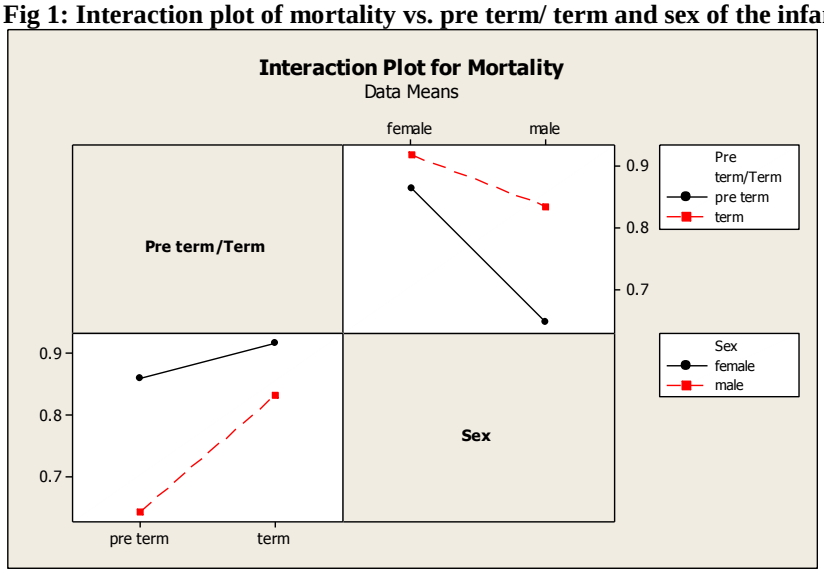
Table 2: Demographic details of LBW babies

Variable	N	Mean	StDev	Minimum	Median	Maximum
BIRTH WEIGHT 1	91	1496.1	389.1	400.0	1500.0	2000.0
ELBW	11	847.3	219.5	400.0	1000.0	1000.0
LBW	39	1811.0	164.2	1500.0	1800.0	2000.0
SGA	19	1443.4	361.8	680.0	1500.0	2000.0
SGA WITHOUT ELBW	12	1575.8	256.4	1000.0	1600.0	2000.0
SGA WITH ELBW,LBW,VLBW	7	1216	421	680	1200	2000
AGE IN DAYS1	90	2.406	5.005	0.021	0.167	27.000

The mean heart rate was 141.5±16.7 (86 – 140) beats/min and hospital stay was 4.5±4.4 (1-26) days. Univariate analysis showed that age in days had positive correlation with HR (r=0.6) and length of hospital stay (r=0.6). In addition, HR showed positive correlation with both length of stay (r=0.7) as well as No.of RF (r=0.6) Univariate analysis showed that preterm babies of either sex had bad prognosis with prognosis being worse in preterm males than in females. In contrary multivariate analysis of factors such as sex, preterm gestation didn't

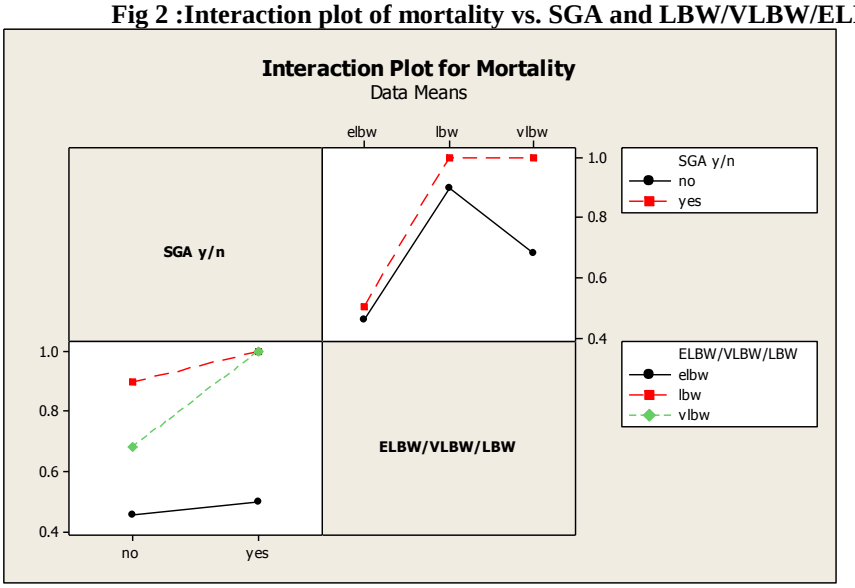
influence the prognosis of the neonate at discharge. Neonates of either sex with preterm gestation who expired had a Pearson Chi-Square = 0.001, p-Value = 0.971, vs. those who survived (Pearson Chi-Square = 0.032, p = 0.86)(Fig: 1)

Fig 1: Interaction plot of mortality vs. pre term/ term and sex of the infant



There is correlation between morbid conditions and birth weight (Pearson Chi-Square = 100.912,p= 0.0001). Over all survival rate was 59.3% and that of LBW, VLBW and ELBW were 65.9%, 65.5% and 26.6% respectively. When birth weight and mortality were taken into consideration, the order of bad prognosis was ELBW > VLBW >LBW. ELBW babies had maximum mortality ((Pearson Chi-Square = 28.000, p= 0.00009). In comparison to SGA babies, babies who were appropriate for age had good recovery (Pearson Chi-Square = 9.000, DF = 3, p=0.03)(Fig 2)

Fig 2 :Interaction plot of mortality vs. SGA and LBW/VLBW/ELBW



There was no difference in HR (p=0.6), and RR (p=0.3) at the time of admission in different weight groups (TABLE 3)

Table 3: Vital parameters

Clinical Variable	Mean	StDev
HR (all)	141.46	16.69
ELBW HR	143.64	13.62
LBW HR	143.13	13.45
SGA HR	137.16	19.59
VLBW HR	141.14	20.62
RR (all)	60.74	18.87
ELBW RR	70.36	25.22
LBW RR	58.97	21.77
SGA RR	58.26	11.13
VLBW RR	61.18	14.14

^HR- Heart rate, RR- Respiratory rate.

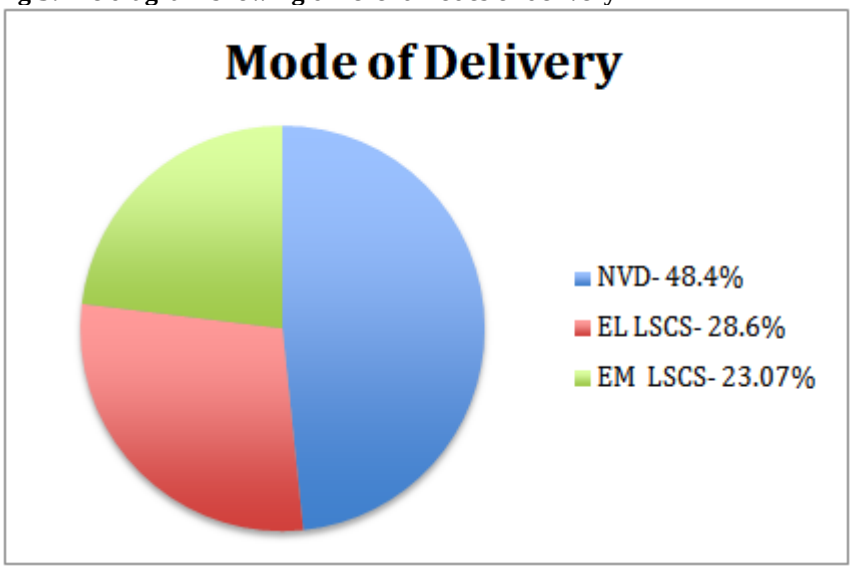
The difference of RBS (p=0.7), Serum Bilirubin (p=0.7),Hb % (p=0.5), TLC (p=0.6), and PC (p=0.75) in different weight groups was not statistically significant (TABLE 4)

Table 4: Details of lab parameters

Lab Variable	Mean	StDev	Minimum	Median	Maximum
RBS	116.6	113.9	41.0	76.0	434.0
TOTAL BILIRUBIN	12.16	4.26	2.80	12.00	22.80
HB	12.333	1.001	10.800	12.400	13.600
TLC	11533	3702	7000	11500	18000
PLT	218333	115311	20000	275000	300000

When the type of delivery was taken into consideration 44 (48.4%) were NVD's vs. 47(51.6%), which were LSCS, of which 26(28.57%) were Elective LSCS and 21(23.07%) were Emergency LSCS (Figure 3 Pie Diagram).

Fig 3: Pie diagram showing different modes of delivery



Univariate analysis showed LBW babies born through NVD had worse prognosis followed by those born through EM LSCS followed by elective LSCS but it was not statistically significant when multivariate analysis was done (Pearson Chi-Square = 11.120, p=0.51).

When Risk factors (RF) were taken into consideration, 40(43.95%)babies were without any risk factors. Any one RF was present in 35(38.46%) babies, 2 RF in 13(14.28%) babies and > 2 in 3(3.29%) babies. (TABLE 5)

Table 5: Risk factors

No of Risk Factors	TOTAL NO.OF BABIES (91)

	No of Babies	Percentage %
0	40	43.95
1	35	38.46
2	13	14.28
>2	3	3.29

As the number of RF increase (1,2, >2) prognosis becomes worse which was shown in both univariate and multivariate analysis (Data mean 0.89 0.85, 0.67 and Pearson Chi-Square = 28.000,p= 0.0000036).

General regression analysis showed the determinants for mortality as birth weight in grams, No.of risk factors and respiratory rate at the time of admission. The regression equation is as follows:

(1) Chance of Mortality = 1.5 + (0.0004 * Birth weight in grams) + (0.1 * no of RFs)

- (0.01 * RR)

Kaplan Meier survival curves of LBW babies are represented in Figure 4,5 that showed maximal mortality was in first 6 days after birth.

Fig 4: Kaplan Meier survival curve

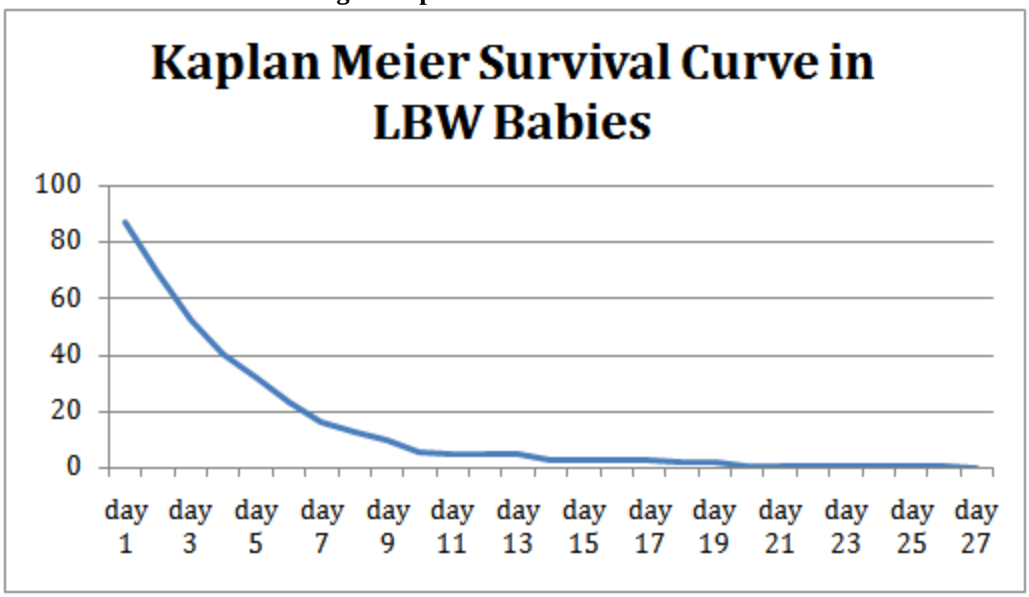
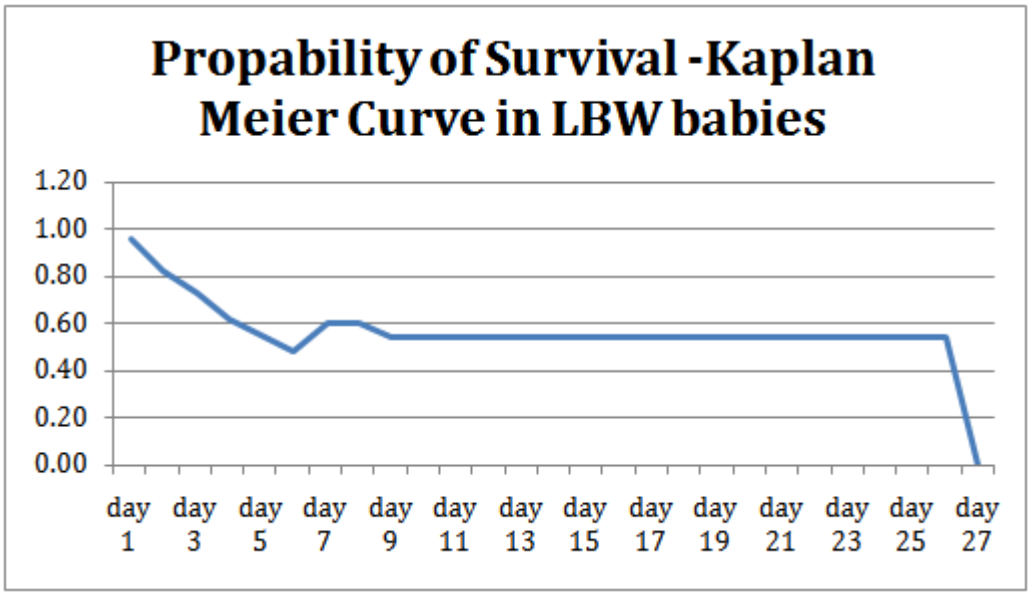


Fig 5: Kaplan Meier curve probability of survival



IV. Discussion

Low-birth-weight babies have a high risk of neonatal and infant morbidity and hence the proportion of babies with low-birth-weight is considered as a sensitive index of nation's health and development. It becomes an indicator of community health and its periodic monitoring helps to estimate the impact of them on preventive health services in the country. In most of the developing countries, low-birth-weight data are biased due to majority of births taking place outside the healthcare facilities, and mothers are unable to provide the data because infants are mostly not weighed at the time of birth. The World Health Organization (1995) estimated that there is a large gap between the incidence of low-birth-weight babies in developing countries (19%) and developed countries (7%). In India, wide regional variations are observed in infant mortality and maternal mortality. It is possibly due to specific cultural and economic factors that prevail in the specific region, which needs to be assessed further. Here, region is taken as an explanatory variable to understand the spatial effect on weighing the newborn and on the birth-weight.

As per D. Manikyamba et al.M: F ratio was 1.1:1 and the incidence of LBW, VLBW and ELBW was 65.56%, 22.57% and 11.85% respectively. 73.8 % were preterm and 26.2% were term IUGR babies [3]. Even in our study (M: F=1.9:1) preterm vs. term were 75.8% and 24.2% respectively. Incidence of LBW, VLBW and ELBW was 42.9%, 24.2%, and 12.1% respectively. Lower incidence of LBW in our study might be due to the difference in the cut off ranges for stratifying babies based on their birth weight and may also be due to the improved facilities available in our region, this being state capital. In variance with other countries and studies likethat of Kutubur Rahman et al. ,Negi K.S et al. , in which the incidence of LBW was 27.14%, 26.8% respectively[4,5]. Our center is one of the famous tertiary care centers throughout India because of which referrals are more and hence the patient load and incidence of LBW. 19 neonates were SGA (20.9%) in our study vs. 63% in a study by Arvind Sehgalet al [6]. This differance may be due to the fact that their study population consisted only VLBW which is likely to have more IUGR babies.

Overall survival rates as per D. Manikyamba et al.was 76% for LBW babies, 32% for VLBW followed by 65% for ELBW babies [3]. Similar result was shown according to the Intensive Care Nursery House Staff Manual where survival data for infants born at UCSF from 1998-2002 (inclusive) weighing between 1,251-1,500 was 95%; weighing between 1,001-1,250 is 92%; weighing 751-1,000 was 82% and those weighing between 500-750 were 74%. They found that survival of VLBW babies is directly related to birth weight [7]. In our study survival rates for LBW, VLBW and ELBW were 65.9%, 65.6% and 26.6% respectively. Lower survival rates in our study especially in ELBW babies may be due to high-risk population referred to our center, our center being the famous referral center in our region. We found the order for bad prognosis in terms of mortality to be ELBW > VLBW > LBW. ELBW babies had maximum mortality in hospital, which was seen even by Arvind Sehgal et al [6]. There was a direct correlation between birth weight and mortality. The reason might be due to the neonatal complications like hypothermia, hypoglycemia, perinatal asphyxia etc.

Neonatal complications are markedly increased in VLBW, and especially ELBW infants. Most VLBW infants are also premature. It may be difficult to differentiate problems due to prematurity from those due to very small size. For this reason we have separated infants who were small for gestational ageand who were LBW from those who were appropriate for gestational age (AGA)and who were LBW. In our study babies who were AGAshowed good prognosis in comparison to those with SGA, which was statistically significant.In addition we have also taken into consideration sex of the infant to see whether there was any change in mortality rateand have found that preterm babies of either sex had bad prognosis with prognosis being worse in preterm males than in females as per univariate analysis but was not statistically significant using multivariate analysis. A similar result was seen by Naikey Minare et al. where mortality rate was same in both sex [8]. Univariate analysis was similar to that of K.K. Roy et al. where overall mortality rate was found to be significantly higher in boys (26.7%) than the girls (16%)[9].

M I Bari et al. have excluded infants with 6 major risk factors such as preterm labour, obstructed labour etc. [10]. In our study one or more of these risk factors contributed to the majority of the cases 51(56.05%). So we have taken into consideration major maternal and fetal risk factors and found that there was an increase in the chance of mortality as the no of risk factors increased from 1 to 3.As per M I Bari et al. morbidity was higher among LBW neonates in comparison to NBWneonates [10]. Even in our study we found that there was a strong correlation between birth weight and morbid conditions, which was statistically significant. In addition heart rate at admission showed positive correlation with the length of the hospital stay in our study.

Incidence of LSCS in our study was high 51.6 % like that ofK.K. Roy et al in which the incidence was around 67.3%[9]. In contrary,previous studies like Kutubur Rahman et al. andBalaji K et al., showed the incidence of LSCS to be 25.4% 38.5% respectively[4,11]. This is because our center is a larger and high-risk tertiary referral center. In addition we have stratified pregnancies into NVD, Elective LSCS and Emergency LSCS to see whether there was any change in the mortality rate in these groups. We found that prognosis was worst for babies born through NVD followed by EMLSCSfollowed by EL LSCS as per univariate analysis but not with multivariate analysis. Usually any emergency surgery is expected to have a bad prognosis but it was

NVD in our scenario. It was found to be a dependent risk factor for morbidity in the logistic model. Our center being a referral hospital, receives cases from all over the state including rural areas where the practice of home vaginal by untrained professionals still exist. Emergency LSCS cases had bad prognosis because most common indication was fetal distress due to various causes like abruptio placenta.Of course, multivariate analysis did not show any difference in mode of delivery and mortality.

As per D. Manikyamba et al. RDS and sepsis were major causes of death in ELBW and VLBW babies. Whereas, sepsis and birth asphyxia were major causes of death in LBW babies [3]. A similar result was seen in the study done by M I Bari et al. where birth asphyxia was the sensitive indicator to assess the health status of newborn at birth [10]. Though we did not calculate individual morbidity/mortality,we have used general regression analysis to develop an equation to calculate the chance of mortality with birth weight, no.of risk factors and respiratory rate being the determinants. The equation is as follows

Chance of Mortality = 1.5 + (0.0004 * Birth weight in grams) + (0.1 * no of RFs) - (0.01 * RR). As per the equation,as the no.of RF increases and if the RR decreases (as in birth asphyxia) chance of mortality increases. The only contrary result is the birth weight, which is unexplained.

Observations based on our study are similar to the study of D. Manikyamba et al.[3]The higher incidence and mortality of LBW especially ELBW babiesin the present study indicates a need for up gradation of NICU facilities and improving newborn care at community level which not only needs advanced equipment but also adequate man power. We need to strengthen the ongoing trainings of health care personnel like NRP and NSSKand providing appropriate antenatal education and care from the grass root level. Improvement of perinatal and neonatal services in the tertiary care centers in Government sector can contribute to achieve the INAP goal of NMR less than 10 by 2030.

V. Conclusions

1) The major determinants for mortality in low birth weight babies were the birth weight number of risk factors and respiratory rate at the time of admission, but not other parameters.
2) Mortality was highest in ELBW followed by VLBW and followed by LBW. Prognosis was better for AGA babies than SGA babies.
3) Neither the sex of the baby nor the mode of delivery influenced the mortality rate. There exists a positive correlation between birth weight and morbid conditions.

VI. Recommendation

By proper health education during pregnancy and strengthening of antenatal services along with bringing better awareness of neonatal problems in the community, it is expected to decrease the incidence and improvethe outcomes of low birth weight babies.

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