International Journal of Clinical Obstetrics and Gynaecology

Dr. Ruwaidha AR
Final Year Post Graduate,
Department of Obstetrics and
Gynaecology, Rajah Muthiah
Medical College, Annamalai
University, Chidambaram, Tamil
Nadu, India

Dr. S Mirunalini
Professor, Department of
Obstetrics and Gynaecology, Rajah
Muthiah Medical College,
Annamalai University,
Chidambaram, Tamil Nadu, India

Maternal risk factors and neonatal outcomes associated with neonates of birth weight <2 kg admitted to a neonatal intensive care unit of a tertiary care centre

Dr. Ruwaidha AR and Dr. S Mirunalini

Abstract
Background and Objectives: Infant mortality is one of the most important measures of health and growth in communities around the world. Low birth weight is one reason why infants die soon after birth. Low birth weight is affected by many social and economic factors, such as where a person lives (urban or rural), their level of education, the order of their children's births, the mother's nutrition, her Body Mass Index, the quality of prenatal care she received, and how far apart her children were born. This study aims at evaluating the maternal risk factors and neonatal outcomes for neonates of birth weight <2 kg admitted to a neonatal intensive care unit of a tertiary care centre.
Methods: The study was a retrospective analysis of 150 babies weighing less than 2 kg, between October 2016 to October 2021. Neonatal resuscitation was done according to American Academy of Paediatrics. The maternal demographic profile, co-morbidities in the mother, factors such as gestational age at delivery, mode of delivery, birth weight were all recorded. Data were put into already-made forms, and statistical analysis was done.
Results: Out of the 150 babies who weighed less than 2kg and were studied, 48 percent were boys and 52 percent were girls. The average weight at birth was 1.63 (SD = 0.28). Based on gestational age at delivery, most (28%) were born between 28 and 32 weeks, were small for their age (n=83, 55.3%), were born normally (n=81, 54%), were born alive (n=122, 81.3%), the mother was between 26 and 30 years old (n=66, 44%), had meconium aspiration syndrome (n=10, 6.75), was taking antenatal steroids (n=106, 70.7%), had a disease during pregnancy Most of the babies had respiratory distress syndrome (n=77, 51.3%), sepsis (n=31, 20.75%), or birth asphyxia (n=23, 15.3%). In this study, a death rate of 19.3% (n=24) was seen.
Conclusion: In order to reduce the number of babies born with low birth weight, the public health strategy needs to focus on better nutrition and education for mothers.

Keywords: Infant, low birth weight, maternal risk factor, neonatal mortality

Introduction

"Health is a state of complete physical, mental, and social well-being, not just the absence of disease or illness," the World Health Organization says. This is the main goal of health services in our country, including the health of mothers and children.

Birth weight is a good indicator of how healthy the mother is. It's also true that a baby's birth weight is the most important factor in neonatal morbidity and mortality.

Low birth weight, or LBW, means that the baby weighed less than 2,500 grammes at birth. This could mean that the baby didn't stay in the uterus long enough or didn't develop properly. Babies who weigh less than the 10th percentile or more than 2 standard deviations below the mean for their gestational age are considered to be small for their age. In developing countries like India, babies with low intrauterine growth retardation (IUGR) are a cause for concern.

Evidence from developing countries shows that the number of IUGR cases goes down as a country grows. Malnutrition, anaemia, lack of prenatal care, drug use, birth order, and health problems in the mother, such as high blood pressure caused by pregnancy, diabetes, heart disease, and chronic infections, are all risk factors [1].

The health of mothers and children in developing countries is one of the most important public health problems. As birth weight goes down, the death rate goes up. The World Health Organization says that about 17 million babies are born too small for their age every year. Most of these babies are born in developing countries [2].

Corresponding Author:
Dr. S Mirunalini
Professor, Department of
Obstetrics and Gynaecology, Rajah
Muthiah Medical College,
Annamalai University,
Chidambaram, Tamil Nadu, India

Every year, more than 8 million babies are born with a very low birth weight (VLB), which is 40% of the world's total. In 2015, South Asia (27%) has the most LBW than any other area. From 2000 to 2015, the number of LBW cases almost stayed the same around the world [3].

India has had a lot of problems with malnutrition and death among children [4-5]. Even though India has made a lot of progress in reducing low birth weight, it is still very high among socially and economically poor groups [6].

The most recent National Family Health Survey (NFHS-4) shows that about 18% of Indian children under the age of 5 were born with LBW in 2015-16 [7] To reach the Sustainable Development Goal (SDG) goal of reducing infant and child mortality by 2030, there still needs to be a faster improvement in reducing LBW.

The main thing that affects the outcome of a very low birth weight (VLBW) baby is the care that is given to the baby before and after birth.

Premature birth and low birth weight, especially in very low birth weight (VLBW) babies, are major causes of death in newborns. Many past studies looked at birth weights that were even lower than 2 Kg.

So, this study was done to find out what makes babies who weigh less than 2 kg more likely to get sick or die, so that the right steps can be taken to lower NMR in this group and reach the target NMR. There aren't many studies about how things are in South Asia right now.

Materials and Methods
Study Design: A Retrospective Study
Study Setting: Neonatal Intensive care unit, Rajah Muthiah Medical College and Hospital, Chidambaram.
Study Period: October 2016 to October 2021 (5 years)
Sample Size: 150
Inclusion Criteria: All Neonates (<2kg) admitted in NICU during the study period shall be included in the study
Exclusion criteria: The study will not include new-borns who weigh less than 500 Gms or who have multiple birth defects that make it impossible for them to live.

Method of Study
After getting permission from the hospital's ethics committee, all babies in the NICU who weighed less than 2 kg were included in the study. The case sheets for mothers and babies were used to get the information that was needed. This information included the mother's age, address, socioeconomic status, educational status, weight, risk factors (like hypertension, anaemia, gestational diabetes, multiple gestation, chronic medical illness, hypothyroidism, HIV status, hepatitis B, and maternal fever), order of birth, gestational age, antenatal steroids, premature rupture of membranes, mode of delivery, and cause of death. Information about the baby includes its gender, whether it needs resuscitation, its Apgar score, its gestational age, its birth weight, its illness, and whether it needs mechanical ventilation or surfactant therapy.

The baby was cared for by following the protocol for neonatal resuscitation from the American Academy of Paediatrics [8].

Asphyxia at birth was diagnosed by looking at new-borns with low Apgar scores (3 after 5 minutes), a history of foetal and/or new-born distress, and laboratory evidence of asphyxia. The staging of hypoxic ischemic encephalopathy by Sarnat and Sarnat was used to predict how bad neonatal encephalopathy would be in the future. To figure out if a baby had meconium aspiration syndrome (MAS), doctors looked at whether the baby

had trouble breathing within the first hour of life or if a chest x-ray showed signs of aspiration pneumonitis.

An apneic spell happens when a person stops breathing for more than 20 seconds, or when they have a slow heartbeat or low oxygen levels that can be seen in the clinic (cyanosis) or by watching their oxygen saturation. The babies who had bouts of apnea were given the standard treatment for apnea of prematurity. They were given a loading dose of 20 mg/kg of caffeine citrate (10 mg/kg of caffeine base) orally or intravenously over 30 minutes. This was followed by a maintenance dose of 5 to 10 mg/kg once a day starting 24 hours after the loading dose.

A chest x-ray and one of the following helped doctors figure out what respiratory distress syndrome was.

Not being able to keep sp02 above 87% with FiO2 at 40%

4/10 Silverman-Anderson score with 40% FiO2

Repeated apnea that needs an intubation

Based on the above reference criteria, RDS was diagnosed and treated with NCPAP, Survanta (4 ml/kg) by INSURE technique in four divided aliquots, and mechanical ventilation, either alone or in combination.

People who had signs of sepsis were taken to the hospital and given antibiotics. Before the medicines were given, a blood culture was done. If the baby didn't have any signs or symptoms, risk factors were looked at. If the baby was born early, it was treated like the case with symptoms. If the baby was born at full term, it was checked for sepsis. If it was positive, it was treated the same way as the case with symptoms. If it was negative, it was watched, and the whole process was done again after 48 hours.

Transient tachypnea of the newborn (TTN) is mild trouble breathing with retraction and cyanosis. Extra oxygen (Fio2 40%) usually helps the baby.

Even though it was caused by a delay in the lung's ability to adapt during transition, the cause was only found after all other possibilities were ruled out. For retinopathy of prematurity, we checked all babies with a birth weight of less than 1500 g or a gestational age of less than 34 weeks. If a baby had been sick before they were born and they were born after 34 weeks, they could be screened (e.g., Those who have had severe respiratory distress syndrome or low blood pressure that needed help from inotropes).

Statistical analysis
Microsoft Excel 2013 was used to organise the data, and SPSS 16 was used to analyse it. Frequencies and percentages were used to talk about qualitative data, while Mean and Standard Deviation were used to talk about quantitative data.

Observation and Results
This retrospective study done at a tertiary care centre among neonates of birth weight <2kg admitted to a neonatal intensive care unit, aimed at studying the maternal risk factors and neonatal outcome among these neonates. Of the 150 babies that were studied, there were 72 males (48%) and 78 females (52%). The mean birth weight was 1.63 with S.D of 0.28. 28% of the babies were within 28-32 weeks of gestation (n=42, 28%), small for gestational age babies (n=83, 55.3%) and inborn (n=122, 81.3%). Table 1 depicts the findings of the study.

Table 1: Characteristics Features of the Study

Characteristics		Frequency & Percentage
Gender	Males	72 (48.0)
	Females	78 (52.0)
Birth weight (Mean SD)		1.63±0.28
Birth weight	< 1.0 kg	12 (8.0)
	1.0 - 1.5 kg	37 (24.7)
	1.5 - 2.0 kg	101 (67.3)
Gestational age	< 28 weeks	8 (5.3)
	28 - 32 weeks	42 (28.0)
	32 - 34 weeks	25 (16.7)
	34 - 36 weeks	40 (26.7)
	37 - 40 weeks	35 (23.3)
Birth weight	AGA	41 (27.3)
	SGA	83 (55.3)
Place of Birth	Inborn	122 (81.3)
	Outborn	28 (18.7)

Tables 2 and 3 show that 69 (46%) of the newborns were born through normal vaginal delivery, 66 (44%) of the mothers were between the ages of 26 and 30, and 106 (70.7%) of the mothers were taking antenatal steroids. Gestational hypertension was the most common disease among the mothers (n=51, 34%).

Table 2: Maternal Details

Maternal Age	Frequency & Percentage
< 20 years	15 (10)
20 - 25 years	61 (40.7)
26 - 30 years	66 (44)
> 30 years	8 (5.3)
Maternal Diseases	
Anemia	29 (19.3)
Gestational hypertension	51 (34)
Gestational diabetes	24 (16)
Hypothyroidism	24 (16)
Fever	24 (16)
Associating Factors	
Multiple gestation	30 (20)
Rh negative	12 (8)
Meconium stained amniotic fluid	10 (6.7)
PPROM	32 (21.3)
Abruptio placentae	9 (6)
PROM	18 (12)
Antenatal corticosteroid	
Antenatal steroid	106 (70.7)

Table 3: Delivery and intervention

Characteristics		Frequency & Percentage
Mode of delivery	LSCS	81 (54.0)
	Labour natural	69 (46.0)
Birth weight	< 1.0 kg	12 (8.0)
	1.0 - 1.5 kg	37 (24.7)
	1.5 - 2.0 kg	101 (67.3)
Resuscitation at birth		65 (43.3)
NCPAP		58 (38.7)
Mechanical ventilation		37 (24.7)
Surfactant therapy		6 (4)

Table 4 shows the morbidity pattern of the study group. Majority of them had RDS (n=77, 51.3%), sepsis (n=31, 20.7%) and birth asphyxia (n=23, 15.3%).

Table 4: Morbidity pattern

Diagnosis	Frequency	Percentage
Necrotizing enterocolitis	3	2
Apnea of prematurity	13	8.7
Intraventricular hemorrhage	3	2
Respiratory distress syndrome	77	51.3
Meconium aspiration syndrome	10	6.7
Sepsis	31	20.7
Asphyxia	23	15.3
Neonatal hypothyroidism	16	10.7
Hypoglycemia	4	2.7
Acute renal failure	3	2
Pneumonia	5	3.3
Shock	2	1.3
Meningitis	5	3.3
Congenital anomalies	8	5.3
Infant of Diabetic mother	24	16
Transient Tachypnea of Newborn	6	4
Seizure	6	4
Hyaline Membrane disease	18	12
Neonatal thrombocytopenia	7	4.7
Hypoxic Ischemic Encephalopathy	2	1.3
Blood or Blood products transfusion	14	9.3
ASD	7	4.7
VSD	5	3.3

Table 5 shows that the mortality observed in the present study was 19.3%

Table 5: Events (n=150)

Events	Frequency	Percentage
Alive	121	80.7
Dead	29	19.3

Table 6 shows that the mortality within 24 hrs of birth was 7.3%, 6.3% in 24 – 48 hours, and 2.7% in >72 hours

Table 6: Deaths (n=150)

Time since birth	Frequency	Percentage
< 24 hours	11	7.3
24-48 hours	9	6.3
> 72 hours	4	2.7

Discussion
A Retrospective study was conducted where new born neonates with birth weight <2 kg admitted in NICU of Rajah Muthiah Medical College and Hospital, Chidambaram between October 2016 to October 2021 (5 years) were included in the study.
150 new born neonates fulfilling the Inclusion and Exclusion criteria were included in the study.

Demographic profile
In our study, Mean maternal age was 25.3±3.3 and Majority i.e. 40.7% of the mother were in the age group of 20-25 years.
In our study, Based on gestational age at delivery, majority i.e. 28% were in 28-32 weeks, 26.7% were in 34-36 weeks, 23.3% were in 37-40 weeks, 5.3% in <28 weeks of gestation.
Based on mode of delivery, 54% underwent LSCS, in 46% it was Normal and 52% were Female, 48% were male.
The mean birth weight in the present study was 1.63±0.28 kgs. 67.3% had birth weight between 1.5 to 2 kg, 24.7% had birth

weight of 1 to 1.5 kg, 8% had birth weight <1kg.

In their study, Kabilan et al. [9] said that the average birth weight was 1.198 pounds, with a standard deviation of 0.211. The average number of weeks of pregnancy was 31.9, and the S.D. was 3.095. Most of them were born between 33 and 36 weeks of pregnancy (n=68, 44.2%), were small for their gestational age (n=89, 57.8%), were only children (n=126, 81.8%), and were born alive (n=152, 98.7%).

Inborn were 81.3% and out born were 18.7%.Small for Gestational age were 55.3% in the present study and 27.3% were Appropriate for Gestational age

Maternal Risk Factors

Distribution based on maternal risk factors and Co-Morbidities show 70.7% were on Antenatal steroids, 34% had gestational hypertension, 20% had multiple gestation, 19.3% were diagnosed with Anemia, 16% were Hypothyroid, 16% had fever, 12% had PROM, 6.7% had meconium stained amniotic fluid.

Kabilan et al.[9] found that 95 of the new borns were born through normal vaginal delivery, 61.7% of the mothers were between the ages of 21 and 30, 137 of the newborns had clear amniotic fluid, 59 of the newborns were on antenatal steroids, and all of them were on Dexamethasone. There were diseases in 33% of the mothers, and gestational hypertension was more common (n=14, 9.6%).

In a similar way, Roy et al. [10] found that anaemia during pregnancy (32.6%), bacterial vaginosis (26%), gestational hypertension (18.4%), and a history of preterm delivery (15.2%) were all common associations, followed by UTI with pyelonephritis (13%), Rh-isoimmunisation (13%), multiple pregnancy (11.9%), heart disease (10.8%), uncontrolled diabetes (9.7%), and antepartum [10].

In a study done by Jaiswal et al. [11], the risk factors for morbidity were found to be multiple pregnancies.

Morbidity profile

In the present study, Morbidity details include IUGR (28%),NEC (2%), Apnea of prematurity (8.7%), IVH (2%), Respiratory distress syndrome (51.3%), Meconium Aspiration syndrome (6.7%), Sepsis (20.7%), Surfactant deficiency (4%), Asphyxia (15.3%), Neonatal Hypothyroidism (10.7%), Hypoglycaemia (2.7%), Acute renal failure (2%), Pneumonia (3.3%), Shock (1.3%), Meningitis (3.3%), Congenital anomalies (5.3%), Infant of Diabetic mother (14.7%), Transient tachypnoea of newborn (4%), seizures (4%), Hyaline membrane disease (12%), Thrombocytopenia (4.7%), Hypoxic ischemic encephalopathy (1.3%). ASD (4.7%) and VSD (3.3%).

Kabilan et al [9]. in their study reported that Majority of them had RDS (n=56, 33.6%).

Roy et al. [10] found that the rates of RDS (38.8% in the ELBW group and 17.1% in the VLBW group) and neonatal jaundice (47.2% in the ELBW group and 24.2% in the VLBW group) were the same as in an earlier study [5]. Almost the same number of babies with IUGR were VLBW (22.8%) and ELBW (22.2%). 10 In the study by Jaiswal et al., the most common health problems in late preterm babies were neonatal jaundice that needed phototherapy (55.1%), respiratory morbidity (10.5%), and low blood sugar (8.8%). 11

The main cause of death in the Thapar K.et al. study was sepsis, followed by HMD and jaundice. Most of them (n=68, 44.2%) were born between 33 and 36 weeks, and most of them (n=89, 57.8%) were small for their age. 12 According to the study by Ghulam Nabi et al., the main cause of death was jaundice. 13 The study by Ballot et al. found that the leading cause of death

was extreme prematurity, followed by HMD and NEC [14].

In the study by Sangamam et al., the most common types of morbidity were Hyperbilirubinemia (16.77%), Hypoglycemia (14.9%), and Hyaline membrane disease (14.86%).

The most common problems for the mother when the baby was born early were anaemia (43.36%) and hypertensive disorders of pregnancy (17.6%).

Preterm babies can get hypoglycemia after birth because their liver glycogenolysis and adipose tissue lipolysis aren't fully developed, their hormones aren't working right, and their hepaticcgluconeo genesis and ketogenesis aren't working well enough.

In the study by Rasania et al., 16.39% of the babies had asphyxia at birth, 28.6% had sepsis, 7.37% had RDS, and 32.78% had hyperbilirubinemia. The number of moderately premature babies who needed help breathing was 47.8% [15].

Neonatal resuscitation

In our study, 9.3% were given FFP transfusion and 0.7% were given Whole blood transfusion.

In the present study, Resuscitation was required in 43.3% of the study population,

In 38.7% of the study population, NCPAP was required.

33.3% of the study population required Oxygen support.

24.7% of the study population needed Mechanical ventilation in the present study

Mortality

Mortality observed in the present study was 19.3%in contrast a higher mortality rate of 45.6% was observed in a study conducted by Mukhopadhyay et al. [16].

In our study, Mortality with in 24hrs of birth was 7.3%, 6.3% in 24-48 hours, and 2.7% in >72 hours.

Mukhopadhyay et al. [16] found that 68 out of 149 newborns died: 9 (13%) in the first 24 hours, 35 (51%) between 2 and 7 days, 18 (26%) between 8 and 28 days, and 6 (9%) after 28 days. Most deaths were caused by sepsis (46%), perinatal asphyxia (20%), and pulmonary haemorrhage (19%). Other problems were very early birth (6%), high blood pressure in the pulmonary artery (4%), apnea (3%), aspiration pneumonia (1%) and NEC (1%).

In contrast, in other studies [17-18] people died within 7 days of giving birth.

Locatelli et al. found that smaller gestational age and birth weight, being female, having a low Apgar score at five minutes, and not getting steroids were all independent predictors of survival [19].

Kabilan et al. [9] found that RDS, which leads to respiratory failure, was the main cause of death. Birth asphyxia, sepsis, and major birth defects were also common causes of death, which shows that the quality of care for newborns needs to be improved before, during, and after birth [9].

Conclusion

Uplifting the socioeconomic status of women, nutritional counselling to reduce anemia should be considered to reduce the incidence of low birth weight babies. Antenatal steroid therapy needs to be more vigorously implemented.

Sepsis and Respiratory distress syndrome were the major cause of death.

Prematurity is the primary cause behind these neonatal death. This emphasizes the need to prevent preterm deliveries. Effective preventive strategies to decrease the preterm birth can only be the next big step to decrease the perinatal morbidity rate

of our state.

References
1. Hivre SS, Gantra BR. Determinants of low birth weight. A community based prospective cohort study. Indian Pediatr. 1994;31:1221-1225.
2. Negi KS, Kandpal SD, Kukreti M. Epidemiological factors affecting low birth weight. JK Sci. 2006;8:31-4.
3. UNICEF, WHO. UNICEF-WHO Low birth weight estimates: Levels and trends 2000-2015. World Health Organization, Geneva: c2019.
4. Swaminathan S, Hemalatha R, Pandey A, Kassebaum NJ, Laxmaiah A, Longvah T, *et al*. The burden of child and maternal malnutrition and trends in its indicators in the states of India: the Global Burden of Disease Study 1990–2017. The Lancet Child & Adolescent Health. 2019; 3(12):855-70. Pmid:31542357.
5. Kumar P, Singhal N. Mapping neonatal and under-5 mortality in India. The Lancet. 2020;395(10237):1591-3.
6. Million Death Study Collaborators. Causes of neonatal and child mortality in India: a nationally representative mortality survey. The Lancet. 2010;376(9755):1853-60. pmid:21075444.
7. IIPS and ICF. National Family Health Survey (NFHS-4), 2015-16. International Institute for Population Sciences, Mumbai; c2017.
8. Weiner GM, Zaichkin J, American Academy of Pediatrics. Textbook of neonatal resuscitation (NRP). 7th Ed. American Academy of Pediatrics and American Heart Association; c2016.
9. Kabilan S, Kumar MS. Morbidity and mortality pattern of very low birth weight infants admitted in SNCU in a South Asian tertiary care centre. Int J Contemp Pediatr. 2018;5:720-5.
10. Roy KK, Baruah J, Kumar S, Malhotra N, Deorari AK, Sharma JB. Maternal antenatal profile and immediate neonatal outcome in VLBW and ELBW babies. Indian J Pediatr. 2006 Aug;73(8):669-73.
11. Jaiswal A, Murki S, Gaddam P, Reddy A. Early neonatal morbidities in late preterm infants. Indian Pediatr. 2011 Aug;48(8):607-11. doi: 10.1007/s13312-011-0105-y. Epub 2010 Nov 30. PMID: 21169647.
12. Kaur A, Thapar K, Chhabra GS, Jaslean. Morbidity and Mortality of very low birth weight babies in a Tertiary level NICU. J Nepal Pediatrics. Soc. 2015;35(3):257-263.
13. Ghulam Nabi Rather, Muzafar Jan, Wasim Rafiq, Imran Gatoo, Sheikh Quyoom Hussain, Mohamad Latief. Morbidity and mortality pattern in late preterm infants as a tertiary care hospital in Jammu and Kashmir, Northern India. J Clinic Diagnos Res. 2015;9(12):SC 01-SC04.
14. Ballot DE, Chirwa T, Ramdin T, *et al*. Comparison of morbidity and mortality of very low birth weight infants in a Central Hospital in Johannesburg between 2006/2007 and 2013. BMC Pediatrics. 2015;15:20. doi:10.1186/s12887-015-0337-4.
15. Rasania M, Muley P. Morbidity profile and immediate outcome of late preterm neonates compared to term neonates in a rural tertiary care hospital of Gujarat. Int J Contemp Pediatr. 2017;4:1329-33.
16. Mukhopadhyay K, Louis D, Mahajan R, Kumar P. Predictors of mortality and major morbidities in extremely low birth weight neonates. Indian Pediatr. 2013 Dec;50(12):1119-23.
17. Sehgal A, Roy MS, Dubey NK, Jyothi MC. Factors contributing to mortality in newborns delivered outside and referred to a teaching hospital. Indian Pediatr. 2000;46:335-337.
18. Sehgal A, Telang S, Passah S M, Jyothi M C Maternal and neonatal profile and immediate outcome in ELBW babies. Pediatric. 2003;40:991-995.
19. Locatelli A, Roncaglia N, Andreotti C, *et al*. Factors affecting survival in infants weighing 750 g or less. Eur J Obstet Gynecol Reprod Biol. 2005;123:52-5.