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Original Research Article

Morbidity profile and short-term outcomes of low birth weight neonates delivered in a tertiary care centre: a prospective observational study

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ABSTRACT

Background: More than 20 million babies (15%) born worldwide are LBW (low birth weight) out of which 90% belong to developing countries. Identification of the timing and pattern of morbidities is expected to aid in the timely management of LBW neonates. Objective of the current study was to determine the morbidity profile and short-term outcomes (3 months) in LBW babies.
Methods: Prospective observational study was conducted in neonatal section, JNMCH, AMU, Aligarh, UP over a period of 2 years which included LBW neonates (n=266) who were regularly screened for the occurrence as well as severity of defined morbidities. Immediate outcome was noted in the form of recovery or mortality and 3 months follow up was done for assessment of growth and development as well as occurrence of complications.
Results: RDS was found as the major morbidity seen in 35% (n=93) followed by sepsis 27.8% (n=74), jaundice 24% (n=63), MAS 21.4% (n=57). On logistic regression analysis, MAS (OR=21) followed by sepsis (OR=9.1) and RDS (OR=4.6) were the common predictors for mortality. Follow-up of 221 babies demonstrated readmission in 9% babies (n=20) with high rate of admission among moderate preterm 45% (n=9) and top fed infants 85% (n=17), 2 succumbed to LOS, signs of developmental lag in 2.7% (n=6), ROP in 3% (n=7) and 7 showed neurological findings on ultrasonography.
Conclusions: Present study has shown MAS, RDS and sepsis as predominant causes of neonatal morbidity and mortality which could be prevented through early identification and timely intervention. Proper counselling at discharge and regular follow-up is equally vital to improve their neurodevelopmental outcome.

Keywords: Low birth weight, Morbidity, Mortality, Short-term outcomes, Neonates

INTRODUCTION

According to WHO, LBW is defined as birth weight of less than 2.5 kilograms regardless of gestational age. Low birth weight continues to be a common neonatal problem affecting more than 20 million babies worldwide and represents about 15% of total births. Around 95% of LBW babies are in developing countries. In India, nearly 8 million babies are born with low birth weight annually, with every 3rd born baby being as low birth weight. The level of LBW babies in developing countries (16.5%) is almost more than double the level of LBW in developed countries (7%).[1] Out of 130 million babies born every year, about 4 million dies in the neonatal period. About ¼th of global neonatal deaths occur in India.[2]

LBW and preterm babies are more prone to illness and death during their initial years of life and are more likely to suffer from common childhood illness like diarrhoea, respiratory infections. The severity of illness is more

prolonged and serious in these babies and often leads to hospital admission compared to normal birth weight infants.[3] Prematurity being one of the main causes of neonatal and infant deaths in India, the high percentage of LBW babies with high morbidity and mortality is directly contributing to the country`s neonatal and infant mortality rates.[4] Since countries vary substantially in healthcare systems, in provision of proactive care for LBW babies and available resources, national data are important for clinicians regarding decision-making and objective counselling of parents.[5]

Proper growth and developmental surveillance, timely follow-up and proper counselling are very important for this vulnerable population. Evaluating the burden of problem as well as estimating the morbidities are also expected to help in strategic planning regarding management of LBW in future. Hence, this study will help to identify the risk factors contributing to the morbidity and mortality in LBW babies admitted in NICU and also suggest recommendations for preventing the adverse outcomes in LBW neonates.

METHODS

This prospective observational study was done between October 2019 to October 2021 in the neonatal section, department of pediatrics, JN Medical College, Aligarh, India. Two hundred and sixty-six LBW babies formed the study group.

Inclusion criteria

Inclusion criterion for current study was neonates delivered at JNMCH with birth weight less than 2.5 kg.

Exclusion criteria

Exclusion criterion for current study were neonates with gross congenital anomalies or those with clinically defined chromosomal syndromes, newborns whose parents were not willing to come for follow up and twin deliveries.

Procedure

The details of the baby at birth, anthropometry and clinical course in the hospital were included in the predesigned proforma. The details of the baby at birth, anthropometry, clinical course in the hospital and details of mother regarding her particulars and diagnosis were entered in the predesigned proforma. Babies were weighed naked on an electronic weighing machine (NBY-30 PHOENIX) with an accuracy of ±10 grams. Supine length was measured using an infanto-meter. Head circumference was measured with a non-stretchable tape with an accuracy of 0.1 cm in a crisscross manner from occipital protuberance to the supraorbital ridges. Chest circumference was measured at the level of the nipples with a non-stretchable tape.

Before discharge, anthropometry was repeated and according to standard NICU protocol, vision testing including evaluation of ROP by ophthalmologist, hearing assessment by OAE or BERA, ultrasound skull evaluation was done and echocardiographic examination for evaluation of any suspected heart disease was done as and when indicated. Follow up of these babies was done during regular visits to well-baby clinic on monthly basis up to 3 months of life. Growth and developmental outcomes were recorded as per standard growth charts (Fenton growth chart) and developmental scales (Denver developmental scale II). Anthropometry, immunization, type of feeding and any new complaint as detected by the parents were also noted and evaluated. All the observations in this study were evaluated statistically. Quantitative data was expressed as mean±SD and qualitative data as frequency and percentage. Pearson Chi-square test and Fisher exact tests were used for categorical variables. Logistic regression analysis was carried out to detect the risk factors associated with mortality. Variables with a p value <0.05 were considered as statistically significant and odds ratio with 95% confidence interval was used to measure the strength of association.

RESULTS

During the study period from October 2019 to October 2021, 266 LBW babies were enrolled. Mean birth weight was 1.83 kg±0.504 grams SD and M:F ratio was 1:1.2 with 36% (N=96) term and 64% (N=170) preterm. Among preterm babies, 8% were extreme preterm, 15% very preterm, 16.5% moderate preterm, 25% late preterm.

Table 1: Demographic data.

Variables	% (n)
Gender	
Male	46.2 (n=123)
Female	53.8 (n=143)
Gestational age (weeks)	
<28 (extreme preterm)	7.9 (n=21)
28-32 (very preterm)	14.7 (n=39)
32-34 (moderate preterm)	16.5 (n=44)
34-37 (late preterm)	24.8 (n=66)
>37 (term)	36.1 (n=96)
Birth weight	
ELBW	6.8 (n=18)
VLBW	26.3 (n=70)
LBW	66.9 (n=178)

(ELBW-extremely low birth weight, VLBW-very low birth weight, LBW-low birth weight).

The major morbidity was RDS 34.9% (n=93), followed by sepsis 27.8% (n=74), jaundice 23.7% (n=63), meconium aspiration syndrome 21% (n=57), and shock 20.7% (n=55) (Table 2). The most common maternal risk factor associated with LBW was observed to be gestational hypertension-13.5% (n=36) followed by

anemia 8.3% (n=22), PROM 7.1% (n=19), diabetes 4.1% (n=11), thyroid disease 2.6% (n=7), inadequate ANC 2.3% (n=6), antepartum hemorrhage 1.1% (n=3) (Table 3).

Table 2: Morbidity profile in LBW neonates.

Morbidity	N	%
RDS	93	34.9
Sepsis	74	27.8
Jaundice	63	23.7
MAS	57	21.4
Shock	55	20.7
Hematological	52	19.5
HIE	34	12.7
Metabolic	34	12.7
Apnea of prematurity	25	9.4
Hypothermia	20	7.5
Pulmonary hypertension	17	6.4
Necrotizing enterocolitis	16	6
Infant of diabetic mother	13	5
Retinopathy of prematurity	7	2.6
TTN	5	2
Bronchopulmonary dysplasia	5	2
Meningitis	4	1.5
Intraventricular hemorrhage	3	1.1

(RDS-respiratory distress syndrome, MAS-meconium aspiration syndrome, HIE-hypoxic ischemic encephalopathy, TTN-transient tachypnoea of newborn).

Table 3: Maternal risk factors associated with low birth weight.

Maternal risk factors	N	%
No risk	162	60.9
Gestational hypertension	36	13.5
Anaemia	22	8.3
PROM	19	7.1
Diabetes	11	4.1
Thyroid disease	7	2.6
Inadequate ANC	6	2.3
APH	3	1.1

(PROM-premature rupture of membranes, ANC-antenatal check-up, APH-antepartum hemorrhage).

Among babies who developed MAS, majority were preterm 72% (n=41) while only 28% (n=16) term babies. The rate of CPAP failure was also observed to be more in babies with severe MAS (20/32) as compared to babies with severe RDS (9/36) (Figure 1 and 2). On univariate logistic regression analysis with mortality as the dependent variable, the morbidities with increased risk of mortality included RDS, sepsis, MAS, shock, AOP, positive CRP and HIE, while treatment modalities associated with increase in mortality were surfactant, CPAP, mechanical ventilation and need for resuscitation. However, on multivariate regression model, MAS, RDS shock, AOP and positive CRP were found as factors significantly associated with risk of mortality (Table 4). The overall mortality rate in this study was 11% and it was found to be high in extremely preterm 58.6% (n=17), followed by very preterm 27.5% (n=8), moderate preterm 10.3% (n=3) and late preterm 3.5% (n=1), while no mortality among term babies. During follow-up of 221 babies for a period of 3 months, it was observed that 20 infants got re-admitted with various complaints with late onset sepsis being the predominant cause. Among these admitted babies, 2 of them succumbed to death. The rate of re-admission was found to be significantly high in top-fed infants ($p<0.001$) and moderate preterm babies ($p<0.001$). Most of the infants were exclusively breast-fed (42%), while 25% partially breast-fed and 16% top-fed. The follow-up results are depicted in Table 5. On follow-up, it was observed that LBW babies had better catch-up growth as compared to VLBW and ELBW neonates (Figure 3).

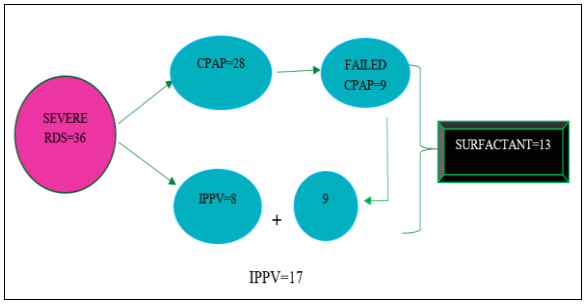

Figure 1 : Neonates with severe RDS requiring various interventions.

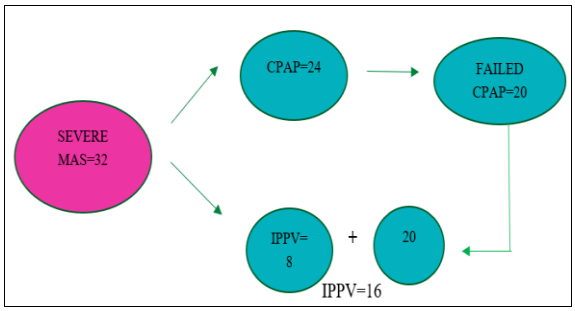

Figure 2: Neonates with severe MAS requiring various interventions.

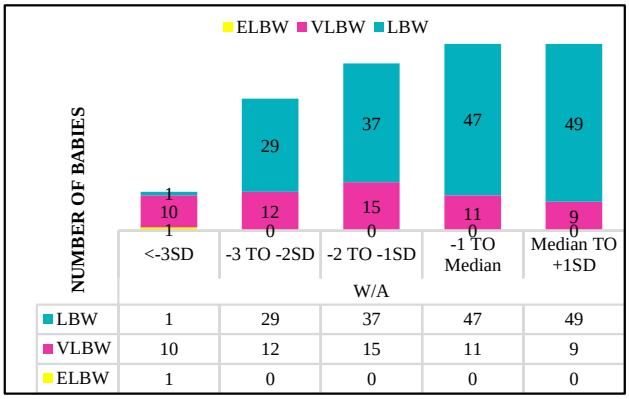

Figure 3: Association of follow-up growth with birth weight.

Table 4: Logistic regression analysis.

Univariate analysis				Multivariate analysis		
Variables	OR	95% CI	P value	OR	95% CI	P value
RDS	4.6	2.8-7.4	<0.001	1.35	0.7-2.7	0.03
Sepsis	9.1	3.8-21.7	<0.001	1.5	0.5-5	0.493
MAS	21	4.9-97	<0.001	1.6	1-2.4	0.02
Positive CRP	3.1	1.3-7.6	0.014	2.6	0.1-4.65	0.021
Positive culture	1.6	0.4-7	0.536	-	-	-
Shock	100	22-446	<0.001	28.3	4.6-174	0.01
Resuscitation	7.9	3.4-18	<0.001	0.9	0.07-12	0.931
Surfactant	47	13-161	<0.001	0.6	0.04-8.9	0.994
CPAP	2.4	1-5.5	0.042	0.6	0.04-7.5	0.665
IPPV	52	38-374	<0.001	0.93	0.01-13	0.993
AOP	39	14-110	<0.001	50	13-188	<0.001
TTN	0.1	0.0-2.2	0.999	-	-	-
Metabolic	0.1	0.04-0.4	0.2	-	-	-
NEC	0.5	0.09-2.4	0.374	-	-	-
PPHN	0.5	0.06-3.8	0.5	-	-	-
HIE	0.1	0.01-0.38	0.046	0.067	0.01-1	0.051

(OR-odds ratio, CI-confidence interval, CRP-C reactive protein, CPAP-continuous positive airway pressure, IPPV-intermittent positive pressure ventilation, AOP-apnea of prematurity, NEC-necrotizing enterocolitis, PPHN-persistent pulmonary hypertension).

Table 5: Follow-up data.

Variables	N (%)
Re-admission (total)	20 (9)
Gestational age very preterm	
Very preterm	6/31 (30)
Moderate preterm	9/41 (45)
Late preterm	5/65 (45)
Feeding	
Breastfed	1 (5)
Partially breastfed	2 (10)
Top-fed	17 (85)
Signs of developmental lag	6 (2.72)
Cranial USG abnormalities	7 (3)
Choroid plexus cyst	3
Periventricular leukomalacia	2
Microcephaly	2
Referred to higher centre	3 (1.4)
Lost to follow-up	16 (7.2)
ROP	7 (3)
Stage 1	3
Stage 2	2
Stage 3	2
Morbidities during follow-up requiring hospital admission	
Gastroenteritis	7/27
LOS with pneumonia	11/11
LOS with meningitis	6/6
AKI	1/1
VSD	2/2

(USG-ultrasonogram, ROP-retinopathy of prematurity, LOS-late onset sepsis, AKI-acute kidney injury, VSD-ventricular septal defect).

DISCUSSION

In present study, term LBW constituted 36% while 64% were preterm out of which majority were late preterm 24.8% (n=66) which was comparable to other studies from India such as in Pabbati et al with 51% preterm and Malik et al with 63.9% of preterm deliveries.[6,7] A higher proportion of preterm delivery reflected the poor maternal health, antenatal check-up and socioeconomic status of the rural society as our hospital catered people from rural areas and from low socio-economic groups. In our study, gestational hypertension constituting 13.5% was the most common maternal risk factor associated with LBW similar to other studies in India.[8-10] In contrast, most of the foreign studies like Gavin et al study showed maternal substance use, maternal depressive symptoms and poor socioeconomic status as the leading causes.[11] Another study from Ethiopia by Desta et al showed previous abortions, hypertensive disorders and <4 antenatal check-ups as the leading co-morbid conditions.[12] The major morbidity in this study was RDS 35% (n=93), followed by sepsis 27.8% (N=74), jaundice 23.7% (n=63), MAS 21% (n=57) and shock 20.7% (n=55).

This spectrum of morbidities was similar to some of the Indian studies.[7,13,14] In contrast, morbidity profile in LBW neonates was found to be widely different in studies from different parts of the world, where CLD, ROP, NEC, IVH topped the list.[15-17] In this study, 57 (21.4%) developed MAS. Although, it is known that the incidence of MAS is very low in preterm and more common in term or post-term babies. In contrast, we found strikingly high incidence of MAS in preterm (78%) as compared to term

babies (28%). This could be due to delay in diagnosis of mothers at risk for uteroplacental insufficiency due poor antenatal check-ups and scarcity of meticulous peripartum monitoring. Moreover, it was also observed that the rate of CPAP failure was more in neonates with severe MAS as compared to severe RDS and a significant association was found between mortality and MAS with p<0.001 and an alarming odds ratio of 21. This clearly necessitates appropriate measures both during peripartum period to prevent in-utero meconium passage in babies as well as aggressive management of meconium aspirated babies during postnatal period.

In our study, most frequent complaint on follow up was found to be acute gastroenteritis 12.2% (n=27) followed by LOS 7.7% (n=17) and pneumonia 5% (n=11) with Sepsis with pneumonia being the predominant cause for hospital admission. In our study, most frequent complaint on follow-up was acute gastroenteritis12.2% (n=27) followed by LOS 7.7% (n=17) and Pneumonia 5% (n=11). Sepsis with pneumonia was found to be the predominant cause for hospital admission. Similar results were found in a 3 month follow up study by Borah et al with respiratory infections (62.5%) as the frequent complaint followed by diarrhea (57.2%) and skin infections.[18] During follow-up growth and developmental assessment, we found better catch-up growth in LBW babies as compared to VLBW and ELBW babies and signs of developmental lag in 6 babies (4 VLBW and 2 LBW). The speed of weight gain decreases rapidly after 3 months and then grow rapidly up to 6 months of age.[19] In our study this could not be concluded because of a short follow up span of 3 months. In multiple logistic regression analysis (Table 4), MAS, RDS, shock, AOP and positive CRP were found to be the independent risk factors contributing to neonatal mortality, which are similar with other studies like in Patel et al from India and Lin et al study from China.[17,20]

Limitations

Limitations of current study were the present study was conducted during the period of COVID pandemic, due to which 16 of the enrolled babies were lost to follow-up. Also, the follow-up duration was short (3 months). Had it been a longer follow-up study, the growth and neuro-developmental outcomes could have been more informative and accurate. Another limitation was frequency of follow-up as in this study the enrolled babies were followed-up on monthly basis instead of twice monthly interval.

CONCLUSION

Present study has shown MAS to be more lethal than RDS and sepsis, which necessitates early diagnosis and meticulous management of meconium aspirated babies. However, the primary cause behind all the neonatal deaths is prematurity. Preventing premature births is the single most important step in reducing our neonatal mortality rate. A strong and effective antenatal program with extensive coverage of all pregnant females especially in outreach areas is the need of the hour to decrease preterm deliveries, which will help us in reducing neonatal and infant morbidity and mortality of the country in coming years.

Recommendations

Mothers should be encouraged to attend ANC visits to detect high risk pregnancies at the earliest, which could be done by strengthening ANC services at every level of health care especially in rural areas. Proper counseling at discharge to care takers regarding maternal nutrition, exclusive breast feeding and need for regular follow-up are equally vital to improve growth and neuro-developmental outcome of LBW babies. Government policies should be aimed at implementing strict aseptic measures in delivery rooms, proper neonatal transport facilities, proper health education with special emphasis on awareness of neonatal problems and maternal nutrition.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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