Original Article

Morbidity and Treatment-Seeking Pattern among Low Birth Weight Infants: A Community-based Cohort Study from Puducherry

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Abstract

Background: To compare the morbidity and treatment-seeking pattern of low birth weight (LBW) and normal birth weight (NBW) infants during the first six months. **Material and Methods:** A prospective cohort study was conducted in the service areas of eight urban primary health centers of Puducherry from October 2019 to July 2021. Details of LBW and sex-matched NBW infants were obtained from the birth registers of selected PHCs. Data were collected using a structured interview schedule on completion of the first, third, and sixth months at their homes. For comparison, Mid-p exact test was used for incidence rates, *t*-test/Mann-Whitney for continuous variables and the Chi-square/Fisher's exact test for the categorical variables. **Results:** Ninety-four pairs of LBWS and NBW infants were recruited. The incidence of morbidity during the first six months among LBW and NBW infants was 37.5 and 33.3 episodes per 100 child months, respectively (*P* value 0.118). Though the incidence of all-cause morbidity was similar, skin infections were significantly higher among LBW (3.10 vs 1.21 per 100 child months, $P = 0.04$). The incidence of all-cause morbidity was high in LBW infants with poor weight gain. **Conclusion:** Birth weight was associated with all-cause morbidity during the first three months. However, this association varied in age points and infants' weight gain.

Keywords: Children, cohort, infants, low birth weight, morbidity

Introduction

Birth weight is usually obtained immediately after birth, preferably within the first hour of life.[1] It is considered an important indicator for assessing the health status of newborn and often reflects the child's intrauterine environment.[2] World Health Organization (WHO) defines low birth weight (LBW) as birth weight less than 2500 g regardless of gestational age at delivery.[3] The primary causes for LBW are intrauterine growth restriction, prematurity, or both.[4]

The UNICEF-WHO report on LBW estimates in 2015 found that globally one in seven live births were born with LBW and nearly half of them were from Southern Asia.[2] As per NFHS 5 report (2019–21), the prevalence of LBW in Puducherry and India was 13.7% and 18.2%, respectively.[5] In India, although the incidence of LBW is coming down each year, achieving a 30% reduction of LBW by 2025 is still a challenge for the Global Nutrition targets.[6]

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LBW leads to poor health status, which affects human capital; poor health status leads to a higher incidence of LBW, and this cycle is continuous.[7] Several studies done all over the world reported LBW as a significant risk factor for infant mortality and morbidity.[8-10] A recent study from India on analysis of under-five mortality rate from 2000 to 2017 reported that LBW and short gestation were the most significant contributors to both neonatal (82.8%) and under-five mortality (45.9%).[11]

Even though several studies examined the relationship between morbidity and birth weight, very few studies in

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India have explored the difference in the incidence rate and treatment-seeking pattern. Treatment care-seeking behaviors and the availability of healthcare facilities are the significant factors determining morbidity.[12,13]

Unlike other parts of India, Puducherry district has a good number of healthcare facilities at all levels of the healthcare delivery system.

This study compared the morbidity and treatment care-seeking patterns of LBW and NBW infants in a setting with adequate healthcare resources.

Materials and Methods

Study design and setting

This study was done as part of an ongoing prospective cohort study conducted in the service area of eight urban primary health centers of the Puducherry district to determine the effect of LBW on morbidity and cost of health care during the first 15 months. This prospective cohort study was started in October 2019 and will be completed in February 2023.

Healthcare facilities of Puducherry Union Territory include one government medical college and one central government-run medical college, 4 CHCs, 39 PHCs, 77 Subcenters, 14 ESI dispensaries, and 17 disease-specific clinics for the 12.48 lakh population.[14] Besides these government facilities, many private healthcare facilities also deliver healthcare services.

Participants and definitions

The study participants were classified as LBW and normal birth weight infants (NBW) based on their birth weight. LBW group included infants with a birth weight less than 2.5 kg, and NBW group has infants born with a birth weight of 2.5 kg or above.

Inclusion and exclusion criteria

Mother–baby dyads who were reported to be available in the study area for the next 15 months were included. Children with severe congenital anomalies or life-threatening illnesses and born with multiple pregnancies were excluded from the study. Since mothers were the sole responder to the study, children whose mothers with severe long postpartum complications with unable to respond to the interview or died in the postpartum period were also excluded from the study.

Sample size

The sample size for this study was calculated in nMaster2.0' (nMaster sample size calculator version 2.0 software, Christian Medical College, Vellore, India) with a confidence interval of 95%, power 80%, OR of incidence of ARI among LBW compared to NBW children during first year is 1.77,[15] a ratio of exposed to unexposed 1:1 and loss of follow up for 20% were considered for the sample size calculation. The final sample size was derived as 188 (94 for each group).

Study procedure

Participants were recruited from the birth registers of selected PHCs after completion of the first month of their life with a window period of 30 days, that is, between 31 and 60 days of their life. Parents of LBW children and corresponding sex-matched consecutive NBW children in the birth registers were contacted. The birth register of PHCs contains details such as the mother's contact details, date of delivery, birth weight, type of delivery, sex of the child, place of delivery, and obstetric history. Mothers were approached by house visits, and consent for the study was taken. Information regarding birth weight was reverified with the hospital discharge summary of the mother. Follow-up house visits were conducted after the third and sixth months of their age within 15 days of the recommended date. Telephonic interviews were conducted during the COVID first wave (Mach 2020 to July 2020) instead of house visits. During the COVID second wave (April to May 2021), telephonic interviews were conducted with mothers who were not willing to do household visits. New enrolment was also suspended during this period. Weight was measured using ISO certified electronic weighing scale during each household visit. During the first visit, a diary and file were given to the study participants to keep all the medical records of children. Mothers who were not willing or not able to contact for household follow-up visits or telephonic interviews during the COVID pandemic period (Mach 2020 to July 2021, April 2021 to May 2021) considered a loss to follow up

Study variables and definitions

Incidence of morbidity: Presence of any reported symptoms of illness by the mother or recorded morbidity within the follow-up period.

Visit to health care facility: This includes visits for treatment of illness (outpatient and inpatient visits), follow-up visits, and visits for suspicion of having a disease. This definition excludes visits for immunization alone.

Visits to health care facility due to morbidities: Visits for seeking medical care for an acute episode of illness/symptoms for the child.

Follow-up visits: Visits are done to monitor health status after an illness episode or sick health status as recommended by the health care personnel.

Non-morbid visits: Visits made to the health care facility due to the suspicion of having illness without any remarkable symptoms.

First point of care: First health care measure taken for an acute episode of illness.

Ethical considerations

The study was approved by the Institute Ethics Committee (IEC no: JIP/IEC/2019/216).

Statistical analysis

Data analysis was done in STATA software version 12.0 (Stata Corp., TX, USA) and IBM SPSS version 21. For comparing the groups, an independent *t*-test and Mann–Whitney test were used for continuous variables, Chi-square test/Fisher's exact test for categorical variables, and Mid *P* exact test for incidence

rates were used. A two-tailed *P* value < 0.05 was considered statistically significant.

Results

Ninety-four pairs of LBW and corresponding sex-matched NBW infants were enrolled from October 2019 to August 2021. Among the LBW children, 54.2% (51/94) were small for gestational age (SGA), 22.3% (21/94) were preterm, and 21.3% (20/94) were both preterm SGA infants. Twelve of the NBW (12.8%) children were also SGA, and 8.5% (8/94) were preterm. The loss of follow-up in LBW and NBW groups were 12.7% (*n* = 12) and 19% (*n* = 18),respectively. The median (IQR) follow-up period age of the children for the first visits, third-month visits, and six-month visits was 45 (37–51), 105 (101–110), and 193 (189–198) days.

The only significant difference observed between the baseline characteristics of participants in the LBW group who have completed all the follow-up visits and those lost to follow-up visits was the mother's educational status. A higher proportion of mothers with graduation and above were lost to follow-up compared to mothers educated up to plus two levels. In the NBW group, mothers who completed the follow-up visits had babies with a higher gestational age of the child at birth compared to those who did not.

Table 1 shows the characteristics of LBW and NBW children. Among the LBW group, only 7.4% (*n* = 7) belonged to the category Very Low Birth Weight (VLBW) (<1.500 kg). The birth weight of the majority of the LBW group (64.8%) belonged to the weight category of 2.000 kg to 2.49 kg, whereas in the NBW group, the majority belonged to the birth weight of 3.000 kg to 3.499 kg. Prevalence of exclusive breastfeeding during six months among LBW and NBW infants was 25.6 and 16.9%, respectively. The major reasons for low prevalence of exclusive breastfeeding were the early introduction of gripe water and plain water along with breast milk. All the infants were given vaccinations according to the national guidelines.

The incidence of morbidities was expressed as rate/100 child months [Table 2]. The incidence of overall morbidities during the first three months was significantly higher (*P* value 0.045) in the children with LBW than the NBW (42.8 vs 32.9 episodes per 100 child months). However, there was no difference in the next 3 months (32.1 vs 33.2 episodes per 100 child months (*P* value 0.682). Among the infants who have completed the first 3 month follow-up visits (LBW *n*: 85, NBW *n*: 84), percentage of infants who had at least one episode of any cause of morbidity during this period among LBW and NBW children is 75.3% (*n*: 64) and 63.1% (*n*: 53), respectively (*P* value 0.086); similarly, children who have completed 6-month follow-up visits ((LBW *n*:82, NBW *n*: 76), the percentage of children had at least one episode of morbidity during the period of 4–6 months is 73.1% (*n*: 60) and 71.1 (*n*: 54), respectively (*P* value 0.429).

Figure 1 shows the relationship between weight gain and any incidence of morbidity. The mean (S.D.) weight of LBW and NBW children at 6 months were 6.520 kg (0.983) and 7.360 kg (1.103), respectively. The incidence of morbidity did not differ much, with varying weight gain in the NBW group. However, it was much higher in the LBW group with less than 3.0 kg weight gain in the first six months of life.

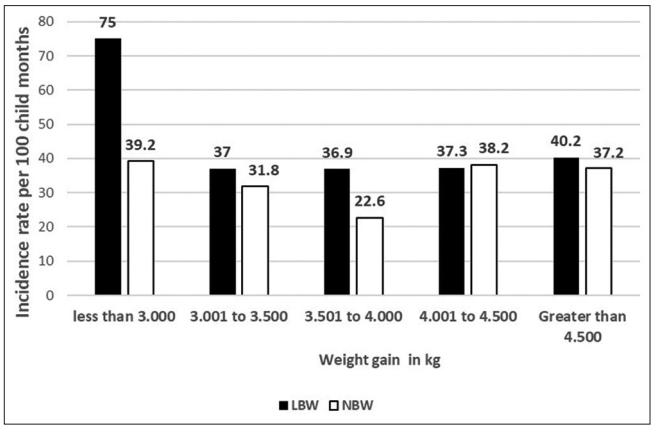

Figure 1: Relationship between weight gain during 6 months and incidence of morbidity

Regarding healthcare-seeking practices between LBW and NBW, overall visits to healthcare facilities were significantly higher in LBW children than in NBW children [Table 3] regardless of morbidity. Table 4 shows the treatment-seeking pattern.

Discussion

Our study compared the incidence of morbidity and treatment-seeking pattern between LBW and NBW children during first six months of life. Even though the incidence of all causes of morbidity during 6 months was higher in LBW children, it was not statistically significant. We have observed that 43.6% of LBW children had health problems at birth; respiratory distress and congenital jaundice were the most reported health problems. Our study reported that the incidence of overall morbidity was higher among LBW infants with poor weight gain than in NBW. The difference in the incidence of morbidity between LBW and NBW was lesser in both groups with adequate weight gain [Figure 1]. This supports the findings of a longitudinal study done in Assam in 2013, which reported a higher incidence of morbidity among LBW with underweight than NBW with underweight.[16] Compared to our study findings, higher morbidity incidence rates between LBW and NBW were reported from longitudinal studies conducted in the urban slums of Kolkata in 2005 and Assam in 2013.[16,17] This may be attributed to the fact that both these studies were conducted in the slum or rural areas with limited access to healthcare facilities. However, similar to our study findings a longitudinal study in Lucknow in 2009 and Ghana in 2011 reported no difference in the incidence of morbidity between LBW and NBW children after the first 3 months.[18,19] We have found a higher incidence of skin infection among LBW children than NBW children. This may be due to the

Table 1: Baseline characteristics of children and mothers in the cohort

Variables	LBW (*n*-94) *n* (%)	NBW (*n*-94) *n* (%)	*P*
Birth weight			
Mean (S.D)	2.07 (0.33)	3.05 (0.329)	
Median (IQR)	2.16 (1.88–2.33)	3.02 (2.78–3.24)	<0.001*
Gestational age in weeks			
Median	37	39	
IQR	(35–38)	(38–40)	<0.001**
Sex			
Male	53 (56.4)	53 (56.4)	
Female	41 (43.6)	41 (43.6)	1
Mode of delivery			
SVD	50 (53.2)	68 (72.3)	
LSCS	44 (46.8)	26 (27.7)	0.007
Place of delivery			
Government	79 (84.0)	81 (86.2)	
Private	15 (16.0)	13 (13.8)	0.838
Birth order			
One	56 (59.6)	44 (46.8)	0.158
Two	33 (35.1)	46 (48.9)	
Three	5 (5.3)	4 (4.3)	
Health problem during birth			
Present	41 (43.6)	22 (23.4)	0.003
NICU admission			
Present	32 (34.0)	6 (6.5)	<0.001
Age group of mothers			
18–25 years	38 (40.4)	31 (33.0)	
26–30 years	32 (34.0)	35 (37.2)	0.562
Above 30 years	24 (25.6)	28 (29.8)	
Educational status of mothers			
Up to high school	32 (34.0)	23 (26.4)	
Plus 2	38 (40.4)	37 (42.5)	0.705
Degree or diploma	13 (13.8)	15 (17.2)	
Above graduation	11 (11.7)	12 (13.8)	
Religion			
Hindu	79 (84.0)	85 (91.4)	
Christian	13 (13.8)	7 (7.5)	0.309
Muslim	2 (2.1)	1 (1.1)	

*t-test,**Mann–Whitney

Table 2: Comparison of incidence of morbidities during the first six months

Morbidity type	LBW (516 child months)		NBW (492 child months)		*P**
	Number of episodes	Incidence rate in 100 child months (95% CI)	Number of episodes	Incidence rate in 100 child months (95%CI)	
All-cause morbidity	194	37.5 (32.4–43.2)	164	33.3 (28.4–38.8)	0.118
Respiratory illness	124	24.0 (19.9–28.6)	114	23.2 (19.1–27.8)	0.776
Diarrhea	17	3.3 (1.9–5.2)	13	2.6 (1.4–4.5)	0.540
Skin infections	16	3.1 (1.7–5.0)	6	1.2 (0.4–2.6)	0.045
Ear infections	4	0.7 (0.2–1.9)	9	1.6 (0.8–3.4)	0.233
Other infectious morbidities	7	1.3 (0.5–1.9)	4	0.8 (0.2–2.0)	0.431
Noninfectious morbidities	21	4.1 (2.5–6.2)	17	3.4 (2.0–5.5)	0.621
Undifferentiated fever	13	2.5 (1.3–4.3)	7	1.4 (0.57–2.9)	0.226

*Two-tailed *P*

less developed or immature skin barrier in the LBW children, which makes them prone to more skin-related infections.[20]

The main reason for the low incidence of morbidity among our study participants may be good accessibility

Table 3: Healthcare utilization pattern

Variables	LBW (516 child months)		NBW (492 child months)		*P
	Number of visits	Incidence rate in 100 child months	Number of visits	Incidence rate in 100 child months	
No. of visits to health care facility	251	48.64	195	39.63	0.031
No. of visits to health care facility due to morbidity	172	33.33	154	31.3	0.571
No. of follow-up visits	47	9.10	15	3.0	<0.001
No. of hospitalization	7	1.35	8	1.62	0.734
No. of nonmorbid visits	25	4.84	18	3.65	0.367

*Mid *P*-exact test

Table 4: Treatment-seeking pattern

Variables	LBW	NBW	*P
Morbidity episodes	194 *n* (%)	164 *n* (%)	
No treatment	12 (6.2)	3 (1.8)	0.040
Home treatment	14 (7.2)	3 (1.8)	0.017
Consult Physician	154 (79.3)	133 (81.1)	0.684
Govt facility	72 (37.1)	64 (39.0)	0.710
Private facility	93 (47.9)	82 (50.0)	0.690
Telephonic consultation	1 (0.5)	4 (2.4)	0.183#
First point of care			
Home treatment	12 (6.2)	3 (1.8)	0.040
OTC	11 (5.7)	13 (7.9)	0.395
Govt facility	56 (28.9)	59 (36.8)	0.151
Private facility	91 (46.9)	73 (44.5)	0.650

*Chi-square test, #Fisher's exact test

to a well-functioning health care system, which provides free and quality health care at all the levels of health care delivery in Puducherry, thereby improving people's health knowledge and behaviors. Total visits to healthcare facilities were comparatively higher in the LBW group compared to NBW. In Puducherry, hospitals where deliveries occurred were conducting special follow-up clinics for LBW children. During this visit, mothers often get guidance for caring for LBW children.

In our study, we did not find any difference in the treatment-seeking pattern between LBW and NBW children. However, we found that the practices of no treatment and home treatment were more common among LBW children. A Study from Ghana also reported the same finding of a higher proportion of absence of care seeking from LBW children compared with NBW children.[19] In both groups, we found that more than 75% of morbidity episodes lead to seeking medical treatment from the formal health practitioner.

Our study was the first community-based prospective study done in Puducherry UT to assess the effect of LBW on morbidity and treatment-seeking pattern. The study has a few limitations, first, loss to follow-up of 15%; out of 30 participants who lost follow-up during follow-up visits, 18 (64.2%) participants were unwilling to participate in the study after the enrolment and 12 (40.0%) participants were unable to contact in both telephone and house visits. The main reason for the loss to follow-up was not willingness to continue in the study during the COVID period even though consent was given at the baseline visit the Second limitation of this study is generalizability; since the study was conducted exclusively in urban areas of Puducherry, generalizability of the study is limited. Third, the chance of recall bias as the morbidity was assessed once in three months.

Conclusion

We observed that along with birth weight, weight gain during the first 6 months plays a major role in the incidence of morbidity. The effect of birth weight on morbidity can be mitigated in a setting with optimum access to healthcare facilities.

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Conflicts of interest

There are no conflicts of interest.

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