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Original Research Article

Risk factors and perinatal outcome associated with low birth weight in a prospective cohort: is there a shift towards sustainable developmental goal 3

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ABSTRACT

Background: Low birth weight is a socio, economic, cultural and community based health issue which reflects responsibility and commitment of local and national administrative authorities. It continues to be a cause of short and long term adverse perinatal outcome with a bearing on adult non communicable health risks.
Methods: This is a prospective observational and analytic study to know the prevalence, risk factors and perinatal outcome of LBW, from July 2017 to December 2018 in department of Obstetrics and Gynecology, MIMS Medical College, Andhra Pradesh, India. Maternal risk factors and outcomes associated with LBW were defined through risk ratios.
Results: 721 infants including 116 LBW and 605 NBW born during study period were included in the study. Prevalence of LBW was 16%. Preterm birth accounted for 35%, FGR for 13.8% and SGA for 51.2% of them. Maternal factors like age <20 years and >35years, social status II to IV, below higher secondary education, house maker, primi gravida, grand multi para, BMI <18.5kg/M^2 or >24.9kg/M^2, Hb<11 gm% were having higher RR for LBW. LBW infants showed frequent association with oligo or polyhydramnious and hemorrhagic or turbid amniotic fluid. They had higher risks for non reassuring fetal heart rate changes, for induced delivery or an elective caesarean section. More often they needed NICU care for longer duration and showed a higher risk for malformations and neonatal mortality. Overall perinatal mortality was 5.54 per 1000 live birth.
Conclusions: LBW is a risk factor for neonatal morbidity and mortality; which can be minimised by institutional delivery. High prevalence PTB (35%) warrants obstetricians to be more vigilant about indentifying the risk factors and adequate management planning. Constitutionally small baby at birth probably needs redefining normal birth weight for different ethnicity.

Keywords: FGR, LBW, Maternal risk factors, Perinatal outcome, Preterm birth, SDG 3, SGA

INTRODUCTION

Birth weight reflects socio cultural and economic empowerment of a community as well as health strategy of the local administration. Low birth weight (LBW) continues to be a key public health issue in safe motherhood projects. It causes adverse perinatal outcome and increased childhood morbidity and mortality. Nearly

three fourth of all neonatal deaths and half of infant deaths occur among LBW infants. It is attributed as a major contributor to most of the adult onset life style diseases which pose a high risk for premature death among adults. Most importantly LBW causes recurrence of low birth weight in off springs.[1-4] LBW is caused by preterm birth or birth of a growth restricted baby. Ever since Barker hypothesized foetal origin of adult diseases, it has been a field of research to change the womb environment which later determines the world environment for the baby. In India, of the 26 million born every year, 8 million are LBW, i.e. around 40% of the global burden of LBW infants. Nearly three fourth of all neonatal deaths and half of infant deaths occur among LBW infants. An LBW baby is at higher risk of both mortality and morbidity compared to the normal birth weight infant.[2,5] Low birth weight (LBW) is defined by the World Health Organization (WHO) as weight at birth less than 2500g and small for gestational age (SGA) as birth weight less than tenth percentile for that gestational age in the general population; Overall, it is estimated that 15% to 20% of all births worldwide are LBW.[2,3,6] Among regions, South Asia has the highest incidence of low birth weight, with one in four newborns weighing less than 2,500grams, approximating at 28%.[3] The goal is to achieve a 30% reduction of the number of infants born with a weight lower than 2500g by the year 2025.[3]

LBW is associated with either preterm birth (PTB) i.e birth before 37+° weeks , fetal growth restriction (FGR) i.e birth weight < 10^{th} percentile for the gestational age with either Doppler or amniotic fluid changes or, constitutionally small babies (SGA) i.e birth weight <10^{th} percentile for the gestation and without pathological changes. Often associated with intrauterine asphyxia, scanty and meconium stained amniotic fluid, intrapartum asphyxia, heart rate changes and low apgar score at birth, followed by need for NICU admission and further management due to its associated morbidity and at times mortality, it adds to the cost of pregnancy and mars the concept of safe motherhood goal.

The aim of this study to know the prevalence, risk factors and perinatal outcome of LBW and to study whether there is any positive shift in the outcome as we reach towards 2025.

To estimate the prevalence and antenatal risk factors associated with LBW, to consider labour outcomes like (spontaneous, or induced labour and elective caesarean) mode of delivery like (normal vaginal, instrumental and caesarean), indications for caesarean, the association with abnormal amniotic fluid and fetal heart rate variability in LBW. To study the perinatal outcomes like mean birth weight, mean gestational age, 1min and 5min apgar score, gender association and neonatal admission to NICU and the neonatal complications associated with LBW in relation to that with normal birth weight (NBW) neonates.

METHODS

This prospective analytic and observational study was undertaken in a cohort of pregnant women attending a teaching medical institution of eastern Andhra Pradesh, India for delivery during July 2017 and December 2018.

Inclusion criteria

- Booked antenatal women in this institute who undertook 4-8 visits before confinement. They were interviewed for a detailed history and their antenatal data were scrutinised at the time of admission to delivery after obtaining written informed consent for participating in the study.

Exclusion criteria

- Deliveries of anomalous babies, intrauterine deaths, still births and multiple gestations, babies with extreme prematurity (<28weeks GA) and unbooked mothers.

We have considered delivery at <37+° weeks as Preterm Birth. Less than 34 weeks as early PTB and Between 34^{+1} to 36^{+6} as late PTB.

We defined FGR neonate as a growth restricted foetus (estimated fetal weight <tenth percentile for the gestational age) associated with either oligohydramnious defined as Amniotic fluid index <5cm and/or Doppler changes or neonatal pathological changes consistent with FGR; SGA being defined as a growth restricted foetus without the former changes.

We defined abnormal amniotic fluid as either scanty (AFI <5 cm) or excessive (AFI >18 cm) liquor, meconium stained, hemorrhagic or turbid liquor. Parameters associated with LBW (birth weight <2500gms) were correlated with NBW (birth weight >2500mgs).

Statistical analysis

Statistical analysis were made by use of 2- way contingency table at 95% confidence level for RR and CI values in bivariate analysis; use of pearson chi2 test to find p value for test of significance for all categorical data and the student -t test was used for the continuous data. P value < 0.05 is considered significant.

RESULTS

Total number of deliveries during study periods were 745 (311vaginal delivery + 434 caesarean delivery). Anomalous (4), still born and IUD (7), twin (12) and extreme prematurity (1); total 24 infants were excluded. We included 721 (299 VD+ 422 CD) infants in the study. Among them (10 early PT+18 late PT +55 term) 83CD + (6 early PT+7 late PT+20 term) 33VD = 116 were LBW and 605 were NBW babies. Prevalence of LBW was 16%

considering all live births >28weeks. Among them 41 (35%) were due to PTB, 16 (13.8%) were due to FGR and 59 (51.2%) infants were SGA (constitutionally small baby) (Figure 1).

Table 1, Bivariate analysis showed maternal age <20 years (RR 1.1; 95% CI 0.56-1.24) and >35 years (RR 2.3; 95% CI 0.77-4.45) were associated with LBW. Home makers had more risk of LBW (RR1.33; 95%CI0.87-2.05). Class I (RR 0.84; 95% CI 0.56-1.24) and higher maternal education (RR 0.79; 95% CI 0.55-1.33) were protective; LBW was seen more often among primi (RR1.18; 95% CI 0.83-1.68) and grand multiparae (RR2.1; 95%CI 0.56-4.46), anaemic, low BMI (RR 1.17; 95% CI 0.75-1.78) and high BMI (RR 2.08; 95% CI 0.10-5.53) mothers. Anemia of increasing severity showed increasing RR towards LBW.

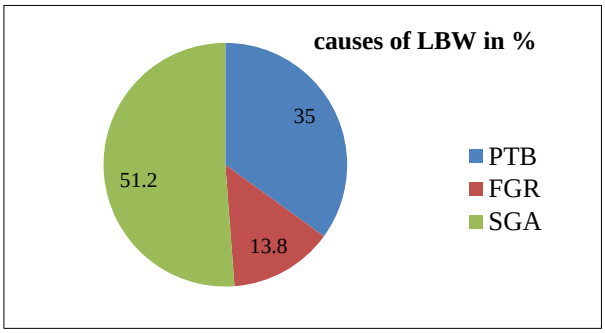

Figure 1: Causes of LBW.

Table 1: Antenatal risk factors associated with LBW.

Parameters	LBW (n=116) (%)	NBW (n=605) (%)	RR (95%CI)
Age			
< 20	26 (22.4)	124 (20.5)	1.10 (0.44-1.20)
21-34	86 (74.1)	474 (78.3)	0.82 (0.56-1.24)
> 35	04 (3.5)	007 (1.2)	2.3 (0.77-4.45)
SES			
I	31 (26.7)	187 (30.9)	0.84 (0.56-1.24)
II	69 (59.5)	346 (51.2)	1.08 (0.76-1.5)
III	13 (11.2)	063 (10.4)	1.07 (0.59-1.8)
IV	03 (2.6)	009 (1.5)	1.57 (0.41-3.68)
Occupation			
HM	90 (77.6)	431 (71.24)	1.33 (0.87-2.05)
Skilled job	15 (12.9)	091 (15.04)	0.86 (0.49-1.43)
Unskilled labor	11 (9.5)	083 (13.72)	0.69 (0.36-1.26)
Education			
Nil	07 (6.0)	026 (4.3)	1.33 (0.59-2.57)
Primary	09 (7.8)	043 (7.1)	1.08 (0.53-1.99)
Secondary	52 (44.8)	245 (40.5)	1.16 (0.81-1.64)
Higher secondary and college	48 (41.4)	291 (48.1)	0.79 (0.55-1.33)
Parity			
Primi	56 (48.3)	261 (43.1)	1.18 (0.83-1.68)
G2-4	57 (49.1)	338 (55.9)	0.79 (0.56-1.13)
G5 and above	03 (2.6)	006 (1.0)	2.1 (0.56-4.46)
BMI			
<18.5	24 (20.7)	107 (17.7)	1.17 (0.75-1.78)
18.5-24.9	85 (73.3)	473 (78.2)	0.80 (0.54-1.19)
25-29.9	06 (5.2)	023 (3.8)	1.3 (0.53-2.61)
> 30	01 (0.8)	002 (0.3)	2.08 (0.10-5.53)
Hb%			
≥ 11	54 (46.6)	330 (54.5)	0.76 (0.53-1.08)
9-10.9	57 (49.1)	262 (43.3)	1.21 (0.85-1.72)
7-8.9	05 (4.3)	012 (2.0)	1.86 (0.70-3.66)
< 7		001 (0.2)	

Table 2, showed that with respect to labour outcomes, abnormal amniotic fluid environment (oligo/polyhydramnious and hemorrhagic/turbid) was more frequently associated with LBW though meconium staining was more often seen among NBW infants. LBW infants were often associated with fetal heart rate abnormalities like tachycardia, bradycardia and late

decelerations. LBW infants were frequently delivered by elective CD (RR1.77, 95% CI 1.08-2.99) or induced labour (RR 2.03, 95% CI 1.03-3.93) than spontaneous labour. With respect to mode of delivery LBW infants had caesarean delivery (at RR 1.98; 95% CI 1.27-2.95) and instrumental vaginal delivery (at RR 1.87; 95%CI 0.66-4.41) more frequently. APH at (RR 3.56, 95%CI 1.42-5.55) and anomalous presentation, preeclampsia and fetal distress all were at higher RR to undergo CD as compared to NBW infants.

Table 2: Crude estimates of risks for labour and delivery outcomes according to birth weight.

Parameters	LBW (n=116) (%)	NBW (n=605) (%)	RR (95%CI)
AF Volume			
Normal	87 (75)	488 (80.6)	1.00
Oligohydramnious	27 (23.28)	113 (18.7)	1.27 (0.83-1.90)
Polyhydramnious	2 (1.72)	4 (0.7)	2.20 (0.39-5.15)
Amniotic fluid (AF)			
Clear	96 (82.7)	521 (86.1)	1.00
Meconium Stained	11 (9.5)	69 (11.4)	0.88 (0.46-1.58)
Hemorrhagic	5 (4.3)	8 (1.3)	2.47(0.95-4.50)
Turbid	4 (3.5)	7 (1.2)	2.33 (0.78-4.54)
Fetal heart rate			
Normal	92 (79.3)	504 (83.3)	1.00
Tachycardia	7 (6.0)	32 (5.3)	1.12 (0.49-2.21)
Early/variable deceleration	5 (4.3)	24 (4.0)	1.07 (0.39-2.34)
Late deceleration/bradycardia	12 (10.3)	45 (7.4)	1.34 (0.73-2.28)
Onset of labor			
Spontaneous	27 (23.3)	223 (36.8)	1.00
Induced	18 (15.5)	128 (21.2)	2.03 (1.03-3.93)
Elective C Section	71 (61.2)	254 (42)	1.77 (1.08-2.99)
Mode			
VD	28 (24.1)	245 (40.5)	1.00
CS	83 (71.6)	339 (56)	1.98 (1.27-2.95)
Instrumental	5 (4.3)	21 (3.5)	1.87 (0.66-4.41)
Indication for CS			
APH	5 (6.0)	4 (1.2)	3.56 (1.42-5.55)
Anomalous presentation	8 (9.6)	9 (2.7)	3.06 (1.52-4.82)
HDP	18 (21.8)	24 (7.0)	2.97 (1.87-4.3)
CTG changes	24 (29.0)	59 (17.5)	2.0 (1.3-2.96)
Oligohydramnious	20 (24.0)	62 (18.3)	1.62 (1.01-2.48)
Diabetes	0 (0.0)	18 (5.3)	-
CPD	4 (4.8)	61 (18.0)	0.36 (0.115-0.95)
Rpt CS	4 (4.8)	102 (30.0)	0.20 (0.06-0.55)
FGR	16 (13.8)	08 (1.32)	4.65 (3.00-6.05)

Table 3, LBW infants had RR5.8 of being born preterm and P=0.001 for mean birth weight. Low APGAR score at1m and 5m were significantly high among LBW infants. There was no significant gender difference between LBW and NBW infants, but a significant difference as preterm and term births were concerned. LBW infants had a low APGAR score at first and fifth minute. There was a significant risk of admission to and prolonged NICU stay for LBW (P= 0.001); this was higher for preterm LBW than term LBW though not significant statistically (P= 0.07). Looking into causes of NICU admission, LBW infants scored higher than NBW in all parameters except meconium aspiration syndrome and hypocalcaemia. HMD and neonatal death were seen among LBW infants, especially when PT. Hyperbilirubinemia was significantly high among PT and LBW infants and being pretern increased the risk by 3.8tims than NBW infants. Congenital deformity was seen more frequently with LBW in a risk ratio of 3.8 times. Birth asphyxia was associated with LBW infants with RR of 2.99 times than NBW infants.

Table 3: Crude estimates of risks for perinatal outcomes according to birth weight.

Parameters	LBW (116)		NBW (605)		P value
	n (%)	wt	n (%)	wt	
Mean birth weight					
Preterm	41 (35)	1.83±0.39	21 (3.5)	2.84±0.294	0.001
Term	75 (65)	2.23±0.175	584 (96.5)	2.99±0.39	0.001
GA					
Early PT < 34weeks	16 (13.8)		00		0.000
Late PT < 37weeks	25 (21.6)		21 (3.5)		0.001 (RR 5.81)
Term ≥ 37weeks	75 (64.6)		584 (96.5)		0.001
Apgar score					
1 minute <7	26 (22.4)		16 (2.6)		0.001
5 minute <7	14 (12.06)		6 (0.9)		0.001
Gender					
Male	62 (53.4)		319 (52.7)		0.887
Preterm	22 (35.5)		7 (2.2)		
Term	40 (64.5)		312 (97.8)		0.001
Female	54 (46.6)		286 (47.3)		
NICU admission					
Yes	53 (45.7)		70 (11.6)		0.001
No	63 (54.3)		535 (88.4)		
Preterm	27 (51)		4 (5.7)		0.001
Term	26 (49)		66 (94.3)		
Days of Hospital stay					
Mean days of NICU stay	9.11±6.32		4.24±1.98		0.001
Preterm	11.0±07.32		3.75±2.75		0.07
Term	7.15±4.42		4.27±2.75		
	PT + Term		**PT+ Term**		
MAS	0+3=3		1+6=7		0.228
Hyperbilirubinemia	9+13=22		2+48=50		0.000 (RR 3.83, CI 1.88-5.19)
Hypoglycaemia	0+2		0+1=1		0.017
Hypocalcemia	1+0		1+0=1		0.191
HMD	5+1=6		0		0.000
Sepsis	4+4=8		0+4=4		0.000
Cong. deformity	0+ 3=3		0+2=2 (CHD,Hirsprung)		0.000 (RR 3.80, CI 1.06-5.96)
Neonatal death	3+0=3	25.86/1000	1	1.65/1000	0.001
Birth asphyxia	10		12		0.000 (RR 2.99, CI 1.60-4.61)

DISCUSSION

Prevalence of LBW in our study was 16%. In a study by Chaudhury AK, LBW was 36.2%; Coutinho et al in their large historical cohort study found it as 14.4%; Manjur Kader et al, studied from data of NFHS 3 as 20.3%.[7-9] Aother study by Mitao M et al, the incidence of LBW was 10.6%.[10] Present study found that preterm birth contributed to 35% of LBW, FGR (13.8%) and SGA (51.2%) neonates. In their study Sangamam reported preterm (gestational age<38 weeks) as 39.56%, IUGR as 45.97% and constitutionally small baby as 11.4%.[11] Present study, revealed among LBW infants Male: Female as 53.4%: 46.6%; among all male infants 16.2% were LBW and among all female infants 15.8% were LBW. In their study Chaudhury AK found M/F ratio as 34.7% and 37.7% respectively.[7] LBW runs a marginal high risk of being female.[8] Present study revealed that socio economic class I, skilled or unskilled workers, higher education, normal BMI and absence of anemia, gravida 2-4 and maternal age 20-34 years protected against LBW, similar to study by Mitao M et al, and Chakraborty P et al.[10,12] Skilled and unskilled job protected in 14%-31% against LBW. Therefore some type of maternal autonomy was protective against LBW. Silvestrin S et al, reported higher maternal education was 33% protective against LBW, which is 21% in the present study.[13] Anemia was prevalent among 53.4% mothers of LBW infants and normal HB% gave 24% protection against LBW. It was 43.3% in a study by sangamam R.[11]

Amniotic fluid abnormality excluding meconium staining and ominous foetal heart rate patterns were associated with LBW infants stressing upon the prevailing prematurity.[8,6] Present study reinforced the observation made by other researchers.[8] Present study showed an increased risk of elective CD and induced labours among LBW infants similar to studies made before.[8,10] LBW infants had apgar score <7 at 1min and 5min in the present study similar to that of.[8,10,11] Looking at indications for CD among LBW infants, ante partum hemorrhage, anomalous presentation, preeclamsia and fetal distress in form of ominous CTG changes and oligohydramnious stood at higher risk than NBW counterparts which is similar to previous studies.[8,10] Maternal diabetes, CPD and repeat caesarean as indications for CD were seen at lower risk among LBW infants.[8]

Considering perinatal morbidity on MAS there was no difference between LBW and NBW infants, in compliance with the observation that LBW infants were protected against MSL which can be explained by high proportion of PTB among LBW. But association with hemorrhagic and turbid liquor indicating intra uterine infection was reflected with a extreme significant difference in LBW infants being diagnosed with sepsis (p =0.000). Hyperbilirubinemia was significantly high among LBW infants, HMD was exclusively a disease among LBW infants in this study. Birth asphyxia can be due to prematurity, intra uterine asphyxia as reflected by heart rate abnormalities and sepsis. All three factors had a statistical significance among the LBW infants and this was reflected by a significant risk of birth asphyxia among LBW infants in present study.

Congenital malfomations are risk factors for LBW. Present study high lights this by (RR of 3.8) extreme significane (P= 0.000) for association with birth defects among LBW infants similar to observation by Coutinho PR et al.[8]

Neonatal death rate was 25.86/1000 among LBW and 5.54/ 1000 among all newborns in the present study. Sangamam reported a NMR of 53.2% among 920 LBW infants.[11] The Indian data is 28% considering all newborns.[14] Present study shows an improved neonatal care had reduced the perinatal mortality rate. Therefore, this study reaffirms the benefit of institutional delivery where NICU care can prevent many perinatal deaths among high risk newborns and reassures of a progressive achievement of United Nations' SDG 3 goal of reducing perinatal death to 12/1000 live births.[15]

CONCLUSION

LBW is a risk factor for neonatal morbidity and mortality; which can be minimised by institutional delivery. High prevalence PTB (35%) warrants obstetricians to be more vigilant about indentifying the risk factors and adequate management planning. Constitutionally small baby at birth probably needs redefining normal birth weight for different ethnicity.

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