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Risk Factors Associated with Mortality of Low Birth Weight Neonates in Neonatal Intensive Care Unit of Misurata Teaching Hospital –Libya / 2015

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Abstract: Low birth weight by international agreement has been defined as a birth weight of less than 2500 grams. Birth weight is the single most important criterion for determining the neonatal and infant survival. Despite consistent efforts to improve the quality of maternal and child health, more than twenty million low birth-weight (LBW) babies are born every year throughout the world. To estimate the proportion of live LBW neonates and proportion deaths among them, to identify the common causes of deaths among such neonates, to find out the maternal risk factors associated with LBW, and to assess the short term outcomes of treated LBW infants. The present study was conducted as a descriptive cross sectional study on a group of 157 low birth weight neonates, who were admitted to neonatal ICU of Misurata Teaching Hospital, Libya. We retrospectively analyzed the hospital records over a period of one year from January 2015 to December 2015. The collected data include the babies' demographic characteristics, history, clinical presentation, Apgar score, maternal risk factors, interventions used and outcome of these neonates. Among the studied 157 LBW Nneonates, (50.3 %) are girls, (48.4%) are boys and (1.3%) are ambiguous. About (77.1%) of LBW babies were survived, while only (22.9%) of them died with more neonatal deaths are founded among girl babies. Majority of LBW neonates are borne to multi-gravid mothers (59.9%) aged 25-30 years (26.7%) and (62.4 %) delivered by CS. Neonates are of LBW (79%), VLBW (14.6%) and ELBW (6.4%) respectively. The majority of them are of gestational age 34-38 Wks (44.6%). There is significant neonatal death among ELBW and VLBW, especially those aged 24-26 Wks. (28.7%) of the studied LBW cases have APGAR score < 7. SROM, drugs, APH, Liquor and HTN are the main maternal risk factors detected (35.7%, 23.6, 8.9% and 8.9%) respectively. The main diagnosis of LBW neonates was RDS, sepsis, congenital anomalies (mainly CHD) and pneumothorax (35.7%, 15.9%, 9% and 2.5%) respectively. Interventions done in our study included 37 LBW neonates used mechanical ventilation, 32 (86.5 %) among them died within < 5 days. Also, 36 LBW neonates used nasal CPAP, only 10 neonates died (27.8 %) before 7 days. Furthermore, single dose of surfactant was used in 100 LBW neonates, among them 70% died. Maternal age 25 to 30, multiparity, prematurity, cesarean deliveries, SROM, using drugs during pregnancy, liquor and having hypertension are significant factors associated with LBW. There is need of increasing pre-pregnancy screening, proper antenatal care, identification of high-risk mothers and defining strategies in order to reduce risk factors of LBW.
Keywords: Low Birth Weight, Risk Factors, Maternal, Neonatal Mortality

INTRODUCTION

Low birth-weight is a weight at birth less than 2,500 grams irrespective of gestational age [1]. Birth weight is the first weight of the fetus or newborn obtained soon after the birth. It should be ideally measured within the first hour of life to avoid significant postnatal weight loss occurring [2].

About 16% of live births world-wide or some 20 million infants per year, are born with low birth-weight (LBW), 90 percent of them in developing countries. The prevalence of low-birth weight (LBW) varies between and within geographical regions. [3] The prevalence of LBW in Asia, North America and Europe is 19.7%, 6.8% and 6.5% respectively. In Latin America the percentage of LBW infants is 10.1% whereas in Africa, it is estimated at 14 % [4].

Birth weight is an important predictor of infant growth, vulnerability to the risk of childhood

illness and the chances of survival.1 Low Birth Weight (LBW) is a sensitive indicator of the socio-economic conditions and indirectly measures the health of the mother and the child.[5] Also, LBW rate is a good health indicator of public health problem including long-term maternal malnutrition, ill health and poor health care. LBW together with preterm delivery has also been recognized as a strong biological predictor of unfavorable developmental outcomes [2].

About 70% of all LBW babies are born preterm before 37 weeks of pregnancy. Some risk factors for low birth weight include low maternal socio-economic status which in turn may lead to poor nutrition, maternal smoking, extremes of reproductive age, and maternal conditions or infections in a pregnancy [6].

Among the health disadvantages associated with low birth weight, there were cognitive deficits, motor delays, cerebral palsy, and other behavioral and psychological problems.[7] LBW has been associated with higher probabilities of infection, malnutrition, cognitive deficits, motor delays, cerebral palsy, other behavioral and psychological problems and handicapped conditions during childhood [1].

Generally the risk of neonatal mortality for LBW infants is 25 to 30 times greater than for infants with normal birth weight, and it increases sharply as birth weight decreases [8]. In most developing countries it was approximated that every ten seconds an infant dies from a disease or infection that can be attributed to low birth weight [4].

Despite several intervention programs have been launched during past decade to improve the health status of mothers and children, the incidence of LBW remained roughly constant between 1990 and 2000 in both sub- Saharan Africa and Asia [3].

The present study was conducted with the aim to estimate the proportion of live LBW neonates and the proportion of deaths among LBW neonates, to identify the common causes of deaths among such neonates, to find out the maternal risk factors associated with LBW, and to assess the short term outcomes of infants with LBW treated at Misurata hospital.

METHODS

Study setting

This study was conducted as a descriptive cross sectional study at the neonatal intensive care unit of Misurata teaching hospital in Libya, based on hospital files records. We retrospectively analyzed the hospital records over a period of one year from January 2015 to December 2015.

Study subjects

Our study included 157 low birth weigh neonates admitted to the neonatal ICU of Misurata teaching hospital, identified as low birth weighs.

Ethical issue

Approval was granted from the hospital administration prior to the collection of data from the hospital records.

Data collection

The collected data includes: maternal risk factors associated with low birth-weight, the babies' demographic characteristics, history, clinical presentation, Apgar score, interventions used and outcome of these neonates. The recorded birth weights were taken within 24 hrs of birth. Data about risk factors during pregnancy was taken from the antenatal cards.

Statistical analysis

Date was analyzed by SPSS software version 18 and the results was summarized, presented and displayed as frequencies and percentage in suitable tables. Statistical analysis of qualitative data was performed using Chi-square test, while fisher exact test was used if there is an expected value in a cell < 5. Results were accepted as significant when ($p < 0.05$).

RESULTS

There is no statistical significant difference in LBW and subsequent neonatal deaths regarding to sex (Table-1).

Table-1: Admissions and mortality of LBW neonates according to gender

Gender	Alive LBW 121 (77.1 %)		Died LBW 36 (22.9 %)		Total LBW N. (157)	
	N.	%	N.	%	N.	%
Boy	57	47.1	19	52.8	76	48.4
Girl	63	52.1	16	44.4	79	50.3
Ambiguous	1	0.8	1	2.8	2	1.3

Chi Square = 0.49 p = 0.48 (Non-Significant)

Table-2: Admissions and mortality of low birth weight (LBW) neonates according to maternal age

Maternal age	Alive LBW 121 (77.1 %)		Died LBW 36 (22.9 %)		Total LBW N. (157)	
	N.	%	N.	%	N.	%
≤ 20	13	10.7	1	2.8	14	8.9
- 25	32	26.4	7	19.4	39	24.8
- 30	32	26.4	10	27.8	42	26.7
- 35	25	20.7	9	25	34	21.6
- 40	14	11.6	8	22.2	22	14
> 40	5	4.1	1	2.8	6	3.8

Chi Square = 23.4 p < 0.001 (Highly Significant)

Majority of low birth weight neonates are borne to mothers aged 25-30 years (26.7%) with significant increase in subsequent neonatal death representing 27.8% of the total neonatal deaths. And that is highly statistically significant (Table-2).

Table-3: Admissions and mortality of LBW neonates according to mothers' parity

Parity	Alive LBW 121 (77.1 %)		Died LBW 36 (22.9 %)		Total LBW N. (157)	
	N.	%	N.	%	N.	%
Primi-gravida	55	45.5	8	22.2	63	40.1
1 - 5	59	48.7	28	77.8	87	55.4
> 5	7	5.8	0	0	7	4.5

Chi Square = 5.3 p = 0.021 (Significant)

Most of cases are borne to multi-gravid mothers (59.9%) and that is statistically significant. Also, there is a statistical significant increase in neonatal deaths among these neonates representing 77.8% of the total neonatal deaths (Table-3).

Table-4: Admissions and mortality of LBW neonates according to mode of delivery

Mode of Delivery	Alive LBW 121 (77.1 %)		Died LBW 36 (22.9 %)		Total LBW N. (157)	
	N.	%	N.	%	N.	%
N.V.D	35	28.9	24	66.6	59	37.6
Elective C\S	28	23.1	5	14	33	21
Urgent C\S	58	48	7	19.4	65	41.4

Chi Square = 17.1 p < 0.001 (Highly Significant)

Most low birth weight neonates are delivered by Urgent CS (41.4 %) with a significant increase in subsequent neonatal death among those borne by NVD (66.6 %) (Table-4).

Table-5: Admissions and mortality of LBW neonates according to gestational age

Gestational age	Alive LBW 121 (77.1 %)		Died LBW 36 (22.9 %)		Total LBW N. (157)	
	N.	%	N.	%	N.	%
22-24 Wks	1	0.8	0	0	1	0.6
-26 Wks	0	0	9	25	9	5.7
-28 Wks	2	1.6	5	13.9	7	4.5
-30 Wks	11	9.1	5	13.9	16	10.2
-32 Wks	22	18.2	6	16.6	28	17.8
-34 Wks	20	16.5	2	5.6	22	14
-36 Wks	36	29.7	2	5.6	38	24.2
-38 Wks	26	21.5	6	16.6	32	20.4
-40 Wks	2	1.6	1	2.8	3	1.9
>40 Wks	1	0.8	0	0	1	0.6

Chi Square = 56.5 p < 0.001 (Highly Significant)

Regarding gestational age, the majority of low birth weight neonates are 34-38 Wks (44.6%) and that is highly statistically significant. There is a significant increase in subsequent neonatal death mainly among those aged 24-26 Wks, 30-32 Wks and 36-38 Wks (25%, 16.6% and 16.6%) respectively (Table-5).

Table-6: Admissions and mortality of LBW neonates according to LBW degree

Birth Weight	Alive LBW 121 (77.1 %)		Died LBW 36 (22.9 %)		Total LBW N. (157)	
	N.	%	N.	%	N.	%
LBW (1.501 - ≤ 2.5 Kg)	108	87.1	16	12.9	124	79
VLBW (1.001 - ≤ 1.5 Kg)	13	56.5	10	43.5	23	14.6
ELBW (≤ 1 Kg)	0	0	10	100	10	6.4

Chi Square = 46.1 p < 0.001 (Highly Significant)

Most neonates are of LBW (79%), while VLBW and ELBW represent only 14.6% and 6.4% respectively. There is a highly significant increase in subsequent neonatal death among ELBW and VLBW (100% and 43.5%) respectively (Table-6).

Table-7: Admissions and mortality of LBW neonates according to maternal risks

Maternal risks	Alive LBW 121 (77.1 %)		Died LBW 36 (22.9 %)		Total LBW ** N. (157)		P. value
	N.	%	N.	%	N.	%	
DM	8	6.6	1	2.8	9	5.7	0.64
HTN	13	10.7	1	2.8	14	8.9	0.24
Drugs	33	27.3	4	11.1	37	23.6	0.07
Polyhydramnios	1	0.8	2	5.6	3	1.9	0.26
UTI	8	6.6	1	2.8	9	5.7	0.64
APH	13	10.7	5	13.9	18	11.4	0.79
SROM	45	37.2	11	30.5	56	35.7	0.59
Liquor	10	8.3	4	11.1	14	8.9	0.84
# of hip	0	0	1	2.8	1	0.6	0.46
pneumonia	0	0	1	2.8	1	0.6	0.46
Hypothyroidism	2	1.6	0	0	2	1.3	0.99
High liver enzymes	0	0	1	2.8	1	0.6	0.46
ICSI	9	7.4	0	0	9	5.7	0.17
Changes in CTG	7	5.8	3	8.3	10	6.4	0.82

**Chi Square = 78.6 p < 0.001 (Highly Significant)

The main maternal risk factors among mothers of the studied neonates are SROM, drugs, APH, Liquor and HTN (35.7%, 23.6, 8.9% and 8.9%) respectively, and that is highly statistically significant. While, there is no significant difference in neonatal deaths due to any of these maternal risk factors (Table-7).

Table-8: Admissions and mortality of LBW neonates according to diagnosis

Maternal risks	Alive LBW 121 (77.1 %)		Died LBW 36 (22.9 %)		Total LBW ** N. (157)		P. value
	N.	%	N.	%	N.	%	
RDS	35	28.9	21	58.3	56	35.7	0.002*
Sepsis	17	14	22	61.1	25	15.9	< 0.001*
TTN	2	1.6	0	0	2	1.3	0.99
Pneumothorax	0	0	4	11.1	4	2.5	0.004*
Pneumoperitoneum	0	0	1	2.8	1	0.6	0.45
Necrotizing enterocolitis	1	0.8	1	2.8	2	1.3	0.81
Birth asphyxia	0	0	2	5.6	2	1.3	0.1
Congenital anomalies	5	4.1	9	25	14	9	< 0.001*
-CHD	3	2.5	4	11.1	7	4.5	0.02*
-Cleft lip & palate	1	0.8	1	2.8	2	1.3	0.81
-Esophageal atresia	0	0	1	2.8	1	0.6	0.45
-Lt Diaphragmatic hernia	0	0	1	2.8	1	0.6	0.45
-Omphalocele	0	0	1	2.8	1	0.6	0.45
-Ambiguous genitalia	1	0.8	1	2.8	2	1.3	0.81

** Chi Square = 69.8 p < 0.001 (Highly Significant)

The main diagnosis of LBW neonates was RDS, sepsis, congenital anomalies (mainly CHD) and pneumothorax (35.7%, 15.9%, 9% and 2.5%) respectively, and these causes are statistically significant. Also, there is a high statistically significant higher neonatal mortality among those neonates associated with these four causes ((RDS, sepsis, congenital anomalies (mainly CHD) and pneumothorax)), while other causes are not significant (Table-8).

Table-9: Admissions and mortality of LBW neonates according to APGAR score

APGAR score	Alive LBW 121 (77.1 %)		Died LBW 36 (22.9 %)		Total LBW N. (157)	
	N.	%	N.	%	N.	%
< 7	19	15.7	26	72.2	45	28.7
≥ 7	102	84.3	10	27.8	112	71.3

Chi Square = 43.3 p < 0.001 (Highly Significant)

71.3% of the studied LBW cases have APGAR score ≥7. There is a high statistical significant increase in neonatal deaths among those with APGAR score < 7 (Table-9).

Surfactant was used in 100 LBW neonates, among them 70% died, and that is statistically significant (Table-10).

Table-10: Admissions and mortality of LBW neonates according to surfactant use

Surfactant use	Alive LBW		Died LBW		Total LBW	
	N.	%	N.	%	N.	%
Single dose	3	30	7	70	10	100

Chi Square = 8.3 p < 0.01 (Significant)

Table-11: Admissions and mortality of LBW neonates according to the duration of mechanical ventilation

Duration of Mechanical Ventilation	Alive LBW 5 (13.5 %)		Died LBW 32 (86.5 %)		Total LBW N. (37)	
	N.	%	N.	%	N.	%
< 5 days	4	80	28	87.5	32	86.5
5 - 10 days	1	20	1	3.1	2	5.4
> 10 days	0	0	3	9.4	3	8.1

Chi Square = 9.1 p = 0.002 (Significant)

Among 37 LBW neonates used mechanical ventilation, 32 neonates died (86.5 %) within < 5 days, and that are highly statistically significant (Table-11).

Among 36 LBW neonates used nasal CPAP, only 10 neonates (27.8%) died before 7 days, but that is not statistically significant (Table-12).

Table-12: Admissions and mortality of LBW neonates according to the duration of nasal CPAP

Duration of Nasal CPAP	Alive LBW 26 (72.2 %)		Died LBW 10 (27.8 %)		Total LBW N. (36)	
	N.	%	N.	%	N.	%
< 3 days	7	27	5	50	12	33.3
3 - 7 days	14	53.8	5	50	19	52.8
> 7 days	5	19.2	0	3	5	13.9

Chi Square = 3.1 p = 0.21 (Non-Significant)

Table-13: Mortality of LBW neonates according to the time of death

Time of death	Died LBW N. (36)	
	N.	%
In 1st day	14	38.9
After 1st day	22	61.1

Chi Square = 0.9 p = 0.17 (Non-Significant)

Among 36 died LBW, 22 neonates died after 1st day (61.1 %) but that is not statistically significant (Table-13).

DISCUSSION

LBW is a public health problem, according to the WHO's estimate, the global rate of LBW in 2000 was 15.5%, and the rate in developing countries (16.5%) was more than double that of developed countries (7.0%) [3]. Birth weight is considered an important sensitive indicator for determining the neonatal and infant survival and indirectly measures the health of the mother and the child [5].

LBW is still remaining a significant cause of morbidity and mortality among neonates and children. Despite efforts to decrease the proportion of newborns with LBW, success has been quite limited and the problem persists in both developing and developed countries [1].

In this study, among the studied 157 LBW Nneonates, (50.3 %) are girls, (48.4%) are boys and (1.3%) are ambiguous. About (77.1%) of LBW babies were survived, while only (22.9%) of them died with more neonatal deaths are founded among girl babies. There is no statistical significant difference in LBW and subsequent neonatal deaths regarding to sex.

In this study, most of the mother of LBW babies admitted to neonatal ICU in Misurata teaching hospital belongs to 25 to 30 years age group. Although this is the recommended reproductive age group, it was responsible for the highest proportion of low birth weight infants. This nearly approaches findings of Siza, 2008 in his study conducted in Tanzania, showed that most of the women who gave birth at the Kilimanjaro christian medical centre were in the 20 to 35 years age group [4]. That was also similar to that reported in the Eastern Africa countries [3] and the findings from a study done by Mathule *et al*., among pregnant women in East Java [9].

On contrary to our study, findings of many similar studies in developing countries, concluded that most of the mother of LBW babies in their studies belongs to the <20 and >30 years whereas, the maternal age of 20-29 years was found to be the most suitable age group for giving normal birth weight babies [1, 10, 11].

Most of LBW neonates in our study were borne to multi-gravid mothers (59.9%). That is in agreement with Makhija *et al*., **[**12] who find an increase in LBW after fourth parity (50%) and Joshi Hs *et al*., [13] who documented 51.28% LBW after 4th parity. There is statistical significant association between parity of mother and LBW. While, other studies done by Yadav et al and Kiran A *et al*., stated that primiparous women had more number (27%) of LBW babies [1, 14].

There was inconsistency in relating parity to occurrence of low birth weight. Other studies have shown that primigravida was found to be significantly associated with LBW [15, 16]. Boo *et al*., [2] identified nulliparity as risk factors for low birth weight but other studies concluded multiparity as the associating factor [15, 17].

Based on the observations of the present study, it was found that out of a total of 157 LBW neonates, 124 (79%) had birth weight more than 1.5 kg, while VLBW and ELBW represent only 23 (14.6%) and 10 (6.4%) respectively. There is a highly significant increase in subsequent neonatal death among ELBW and VLBW (100% and 43.5%) respectively. It is similar to what observed in many hospital based studies done in Nepal [1, 18-20]. While, in a study from South Africa, neonatal death rates for various weight categories was reported to be highest among neonates weighing 1000-1499 g [21].

As expected, low birth weight neonates were higher in babies whose gestation ages were below 38 full weeks. The majority of LBW neonates are 34-38 Wks (44.6 %) and a significant increase in subsequent neonatal death appears mainly among those aged 24-26 Wks. Low gestation age was the variable that had the highest association with low birth weight. This observation is in line with findings of many studies done in many developing settings regions of the world [2, 4, 22-26]. These findings indicate the effect of prematurity as a common risk factor for low birth weight in developing countries as identified in previous studies [2, 4, 26].

However there is one study that identifies that this association is inadequate. The authors report that prematurity may be related to incorrect calculation of the probable date of delivery and to the increased occurrence of cesarean deliveries [27].

In this study, cesarean deliveries were present in 62.4% of LBW births, a fact commonly found in the population of a better economic index, and which represents an incidence factor of premature births. Delivery using caesarian section was found to have more risk in developing LBW compared to infants delivered via vaginal delivery. However, this association should be interpreted with caution as most of the mother needs to deliver by CS were complicated cases with threatened maternal condition but still in premature gestation.12 There is a significant increase in subsequent neonatal death among those neonates borne by NVD (66.6 % of total deathes). These findings agree with those of Mendes *et al*., [22] while, it disagrees with the findings of Sutan *et al*., in their study, where CS was not found to be significant [2].

In the present study maternal risk factors had a significant association with LBW. 23.6% of mothers were using drugs and others had some complications during their pregnancy. Among all maternal risks, the proportion of SROM was maximum 35.7% and also

proportion of Liquor and HTN were 8.9%. While, there is no significant difference was detected in neonatal deaths due to any of these maternal risk factors. It is similar to what observed the studies of Yadav *et al.*, [1] Idris *et al*., [13] and Deswel *et al*., [28].

In our study, maternal hypertension had significant association with LBW infants. This condition can lead to a low birth weight for the baby or premature delivery which poses additional health risks to the child. These results indicated that hypertensive disorders might play a critical role in the incidence of LBW as supported by other studies [2, 29, 30].

71.3% of the studied LBW cases had APGAR score ≥7, with significant increase in neonatal deaths among those with APGAR score < 7. Among 36 died LBW, approximately 22 neonates (61.1 %) died after 1st day but that is not statistically significant.

The main diagnosis of LBW neonates in our study was RDS, sepsis, congenital anomalies (mainly CHD) and pneumothorax (35.7%, 15.9%, 9% and 2.5%) respectively, showing a statistically significant association with LBW and subsequent neonatal mortality among those neonates with these four causes.

Interventions done in our study included 37 LBW neonates used mechanical ventilation, 32 among them died (86.5 %), most of them died within < 5 days. Also, 36 LBW neonates used nasal CPAP, only 10 neonates died (27.8 %) before 7 days. Furthermore, single dose of surfactant was used in 100 LBW neonates, among them 70% died, and that is statistically significant.

As a result, we recognize the need to invest in the quality of prenatal care in our country, thus bringing an impact on reducing incidence of LBW infants and improving their survival.

CONCLUSION

This study suggests that there are several risk factors associated with LBW infants in Misurata teaching hospital. Maternal age 25 to 30, multiparity, prematurity, cesarean deliveries, SROM, using drugs during pregnancy, Liquor and having hypertension were identified as significant factors. LBW neonates are mainly among neonates with RDS, sepsis and congenital anomalies, especially CHD.

Therefore, the importance of pre-pregnancy screening, proper antenatal care and identification of high-risk mothers needs to be strengthened. Efforts should focus on preventing or reducing incidence of pre-term delivery, SROM and hypertension and use of drugs during pregnancy with precautions, as these are the recognized risks for LBW infants.

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