

Morbidity and Mortality Pattern of Preterm Low Birth Weight Neonates Admitted in Amhara Region Referral Hospitals of Ethiopia Retrospective Follow-Up Study

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Abstract

Introduction:

Being born preterm low birth weight was found as the main risk factor for neonatal mortality and development of different morbidities. Even though prevalence of preterm low birth weight neonates is high. There is information gap about prevalence of their morbidity and mortality pattern in this study area.

Objective

This study was conducted to assess morbidity and mortality pattern of preterm low birth weight neonates admitted in Amhara region referral hospitals of Ethiopia.

Methodology:

Retrospective follow up study was conducted on preterm low birth weight neonates admitted in Amhara region referral hospital between January 01 /2017 and December 30 /2018. Data were entered to Epi-data 4.4.2.1 and exported to STATA 14 for cleaning and analysis. Logistic regression model was used to analyze the data.

Result

This study revealed that 37.8 %(95%CI: 32.4–43.5) participants were died. The most common morbidities found in preterm low birth neonates was 219 (75.26%) hypothermia followed by 201(69.07%), 145(49.83%), 39(13.4%) and 24(8.25%) with sepsis, RDS, jaundice, congenital anomaly morbidities respectively. Sepsis (AOR: 2.06(95% CI: 1.05–4.02), RDS (AOR: 3.28 (95% CI: 1.81–5.95), congenital abnormality (AOR: 3.14(95%CI: 1.16–8.54), hypoglycemia (AOR 3.81(95%CI: 1.27–11.44) were independent factors of mortality

Conclusion

In this study, mortality of preterm low birth neonatal was higher and public health issue. Hypothermia, Sepsis, RDS, jaundice and congenital anomaly were common morbidities. Sepsis, respiratory distress, hypoglycemia and congenital anomaly were factors of mortality.

Introduction

Globally, in 2017 there were about 5.4 million under five mortality, out of which 2.5 million were died in the first 28 days, with approximately two third and 80% of the neonates were delivered with preterm and low birth weight respectively(1)..Increasing number in delivery of preterm low birth weight (LBW) neonates were one of the leading causes for the leveling off infant mortality and neonatal mortality rates in 2013 in United States of America (2). In many Asian and African countries being born preterm LBW were found as the main risk factor for development of different morbidities and neonatal mortality (3, 4). In Sri Lanka, about 28% of neonates were died due to Low birth weight and prematurity (4).

Preterm LBW related morbidities were found as main causes of admission in neonatal intensive care unit (NICU). In Bangladesh 12.4% of admission were due to preterm LBW and preterm LBW were the cause for 6.5% of deaths (5). Furthermore preterm LBW lead to prolonged stay of neonates in the hospital and can lead to adverse neurodevelopmental outcome shows greatest concern for the family and the society in future (6). .In different regions of Ethiopia being born preterm low birth weight was the major contributor for neonatal deaths and neonate born with less birth weight and preterm showed higher mortality during the neonatal period than normal birth weight and term neonates(7, 8)(9)(10). In southwest region of Ethiopia from all neonatal deaths of 22.8%, more than two third (76%) of death were caused by LBW and prematurity (10).

Despite the initiation of modern techniques of NICU facilities, preterm LBW neonates are still at high risk for the development of numerous morbidities (11).The overall mortality of preterm low birth weight neonates varies depending on the pattern of morbidities (12). Preterm low birth weight neonates are predisposed to infectious diseases due to their immature immune system and develops many sever morbidities such as; hypoglycemia, respiratory distress syndrome (RDS) (13), sepsis ,jaundice, apnea and birth asphyxia(14, 15). The rate of mortality rate in preterm LBW neonates was different depending on morbidity type (16, 17).The risk of developing morbidities was varying in different category of preterm LBW neonates. The extremely low birth weight (ELBW) and extremely preterm neonates had higher rates of all the morbidities and mortalities(18).

Some trials are started to implement now for prevention of preterm LBW birth and reductions of neonatal morbidity and mortality related with preterm LBW. The sustainable development goal three emphasizes on reducing neonatal deaths with goal of 12 neonatal deaths per 1000 live births per country by 2030 through different interventions including of: kangaroo mother care and extra support for feeding Low birth weight and preterm babies with breast milk and other many interventions at postnatal period (19).

Despite these trials many finding of previous studies in Ethiopia had identified high prevalence of preterm LBW neonates and had higher risk of neonatal morbidity and mortality in those preterm LBW neonates. Eventhouh preterm LBW birth is high to our knowledge there is information gap about prevalence of morbidity and their mortality in preterm low birth weight neonates in this study area; therefore, this study is planning to fill this information gap.

Method And Materials

Study area, design and period

The study was conducted in selected referral hospitals of Amhara region. Among from all four referral hospitals in the region; Felege Hiwot Referral Hospital (FHRH), Debreworkos, Dessie and Debrebirhan, two of them were selected by lottery method (FHRH, Dessie referral hospital). Institutional based retrospective follow up study was conducted among preterm LBW neonates admitted in NICU ward of selected Amhara region referral hospitals between January 01/2017 and December 30 /2018. The study was conducted from December 2018 to June 2019.

Population, eligibility criteria

All neonates with gestational age of less than 37 weeks weighing 500-2499g admitted in Amhara region referral hospitals of NICU ward were source population. All selected preterm low birth weight neonates admitted in Amhara region referral hospitals of NICU ward from January 01/2017 to December 30 /2018 were study population. Live birth neonates with gestational age of less than 37 weeks weighing 500-2499g admitted in Amhara region referral hospitals of NICU ward were eligible in the study.

Sampling techniques and procedure

From four referral hospitals found in the Amhara region, FHRH and Dessie Referral Hospital were selected by lottery method. All preterm LBW neonates admitted in NICU ward between January/ 1 /2017- December/ 30 /2018 were recruited by using admission registration book by recording their medical record number sequentially. The samples were proportionally allocated for each hospital. Simple random sampling technique was used to select required number of study participant's.

Variables of the study

The dependent variable was outcome of preterm LBW neonates dichotomized into death or alive. The independent variables of the study were include: Socio-demographic variables (Sex of neonate, age of neonate, age of mother), Maternal and obstetric related variables (Maternal disease (HIV, DM), pregnancy status, Pregnancy induced hypertension), complication/morbidity related variables (Sepsis, necrotizing enterocolitis, intraventricular hemorrhage, asphyxia, RDS, jaundice, pulmonary hemorrhage, congenital anomalies, hypothermia, hypoglycemia) and neonatal related variables (place of delivery, mode of delivery) were included.

Data collection tools and procedures

After reviewing of different literatures, the checklist was adapted to address the objective of the study. The checklist consists of the information on maternal and neonatal socio-demographic data, neonatal related factors, complication/morbidity factors, maternal and obstetrics related factors. Data were extracted from each individual neonatal medical chart by using a structured checklist adapted from different literature.

Data quality assurance

To insure quality of data, different measures were undertaken. One day training was given to data collectors and supervisors on the objective of the study and how to gather information by using the prepared data extraction checklist. Data were collected by six nurses working in NICU who were taking NICU training. One MSC nurse supervisor was assigned for support and facilitation of data collection in each selected site of data collection area. Supervision of data collectors about data collection process was done by supervisor. Supervisor checked daily evaluation about completeness of the filled checklist.

Data processing, analysis and presentation

After checking data completeness and consistency, the collected data were coded and entered to Epi-data statistical software package version 4.4.2.1. Then the data exported to STATA version 14 for cleaning and analysis. Descriptive statistics was carried out and presented using tables, and texts. Bivariate and multivariable analysis was done in logistic regression to determine the association between factor variables and the dependent variable. Based on bivariate analysis, those variables having p-value < 0.25 in the binary logistic regression were transferred to the multivariable analysis and those variables having P-value < 0.05 at 95% confidence level were considered as independent factors for mortality of preterm low birth weight neonates. The final measure of association between independent and dependent variables was expressed by adjusted odds ratio.

Results

Two hundred ninety one preterm low birth neonates' charts were reviewed and each individual preterm low birth weight neonates had different length of hospital stay.

Neonatal and maternal socio-demographic characteristics.

From 291 total sampled preterm low birthweight neonates, majority 185 (63.57%) were male. Two hundred five (70.45%) mothers were belonging to the age category of 20–34 years old.

Maternal and obstetrics related characteristics

Majority 45 (15.46%) of preterm low birth weight neonates were born from mothers who had a diagnosis of pregnancy induced hypertension.

Neonatal related characteristics

Two hundred seventy three (93.81%) preterm low birth weight neonates were born in health institutions. Majority (79.73%) of the preterm low birth weight neonates were born via vaginal mode of delivery. Two hundred nineteen (80.22%) preterm low birth weight neonates had less than seven APGAR score at first minute. One hundred fifty two (55.68%) preterm low birth weight neonates had more than seven APGAR score at five minute.

Morbidity And Mortality Pattern

Preterm Low birth weight related morbidities characters

In this study 219 (75.26%), 201(69.07%), 145(49.83%), 39(13.4%), 24(8.25%), and 21(7.22%) 10(3.44%), 23(7.9%) and 7(2.41%) of neonates were diagnosed with hypothermia, sepsis, RDS, jaundice, congenital anomaly ,hypoglycemia, necrotizing enterocolitis ,meningitis, and perinatal asphyxia morbidities respectively.

Factors of preterm low birth weight neonatal mortality

In this study, the overall proportion of preterm low birth weight neonatal mortality was 37.8 %(95%CI: 32.4–43.5). In this study Sepsis, RDS, congenital anomaly and hypoglycemia were remained independent factors of mortality for preterm low birth weight neonates (Table.5).

In this study preterm low birth weight neonates with sepsis had 6% higher odds of mortality as compared to neonates without sepsis (AOR: 2.06(95% CI :1.05–4.02). Preterm low birth weight neonates diagnosed with RDS had 3.28 times higher odds of mortality than preterm low birth weight neonates without RDS (AOR: 3.28 (95% CI: 1.81–5.95). Preterm low birth weight neonates with congenital anomaly had 3.14 times odds of mortality as compared to preterm low birth weight neonates without congenital abnormality (AOR: 3.14(95%CI:1.16–8.54).Preterm low birth weight neonates with a diagnosis of hypoglycemia had 81% higher of odds of mortality than their counterparts (AOR 3.81(95%CI: 1.27–11.44).

Discussion

This retrospective follow up study was carried out to determine pattern of preterm LBW neonates' morbidity, mortality and factors associated with their mortality. In this study, the overall proportion of preterm low birth weight neonatal mortality was 37.8 %(95%CI: 32.4–43.5). This result is higher than studies conducted in India 6.5%(18)and Iran 28.7%(20). The difference from study in Iran might be that study was excluded neonates with severe fetal malformations whereas this study did not exclude those neonates, which may increase mortality risk. The discrepancy from study in India may be due to that the study focusing only on short-term outcomes, whereas our study was on neonatal period.

However, this result is lower than study conducted in Isfahan city, Iran 64.4 %(21)and Telangana, India 88.8%(22). The possible reason for this difference might be difference in inclusion criteria, where study in Iran involves neonates with birth weight category of less than one thousand five hundred grams and gestational age of less than thirty weeks. The risk of mortality may become high as birth weight of and gestational age of neonate is decreased.

Our study was also revealed that neonatal hypothermia (75.26%), Sepsis (69.07%), RDS, (49.83%), jaundice, (13.4%) and congenital anomaly (8.25%) were the most common morbidities and reason for

admission to NICU. This result is supported by studies conducted in Sharda hospital, India (16), Western Nepal(17), Telangana, India(18), Isfahan city, Iran(21), teaching hospital, Telangana, India (22), New South Wales and Australian Capital Territory(23).

In this study preterm low birth weight neonates with sepsis had 6% higher odds of mortality as compared to neonates without sepsis (AOR: 2.06(95% CI :1.05–4.02). This result was supported by the study conducted in Telangana, India (18) New South Wales and Australian Capital Territory (23), Mahatma Gandhi Memorial Government Hospital, India (24). The possible reason might be that preterm low birth weight neonates mostly had immature host defense mechanisms makes them susceptible to devastating infection that finally may lead to neonatal death.

In addition Preterm low birth weight neonates diagnosed with RDS had 3.28 times higher odds of mortality than preterm low birth weight neonates without RDS (AOR: 3.28 (95% CI: 1.81–5.95). This result was supported by study conducted in Aga Khan University Hospital, Karachi, Pakistan(6), Telangana, India(18), New South Wales and Australian Capital Territory (23), Mahatma Gandhi Memorial Government Hospital, India(24). The possible reason might be that neonates with RDS had complication of lung collapse that may facilitate death easily in preterm low birth weight neonates.

Preterm low birth weight neonates with a diagnosis of hypoglycemia had 81% higher odds of mortality than their counterparts (AOR 3.81(95%CI: 1.27–11.44). This was supported by study done in Telangana, India (18), Mahatma Gandhi Memorial Government Hospital (24). This might be due to the fact that preterm neonates had immature organ that leads to failure in glycogen storage may end up with death. In addition this study found that preterm low birth weight neonates with a diagnosis of congenital anomaly had 3.14 times higher odds of death as compared to their counterparts (AOR: 3.14(95%CI:1.16–8.54). This result is supported by other studies conducted in Telangana, India(6), Mahatma Gandhi Memorial Government Hospital, India(24). The possible reason might be preterm low birth neonates with congenital anomalies have risk of developing different systemic complication like neurological, cardiovascular, respiratory and gastrointestinal those can may lead to mortality.

Conclusion

In conclusion, this study revealed that morbidity and mortality of preterm low birth neonatal death was higher in this setting than national estimates of SDGS and findings of Ethiopian demographic health survey 2019. Hypothermia, Sepsis, RDS, jaundice and congenital anomaly were the most common morbidities. Neonatal sepsis, respiratory distress, hypoglycemia and congenital anomaly were independent factors of mortality among preterm low birth weight neonates.

Abbreviations

DM

Diabetes Mellitus, FHRH:Felege Hiwot Referral Hospital, GA:Gestational Age, HIV:Human Immune Virus, LBW:Low Birth Weight, NEC:Necrotizing Enterocolitis, NICU:Neonatal Intensive Care Unit, PIH:Pregnancy Induced Hypertension, PTLBW:Preterm Low Birth Weight, RDS:Respiratory Distress

Declarations

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Availability of data and materials

The raw data file could be provided for research purpose only, upon request via e-mail of the corresponding author.

Authors' contributions

All authors contributed equally to this work.YD, BF, MS \$ DT participated in all phases of the study including topic selection, design, data collection, data analysis and interpretation. All authors also contribute to write this manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

No applicable

Ethics approval and consent to participate

To conduct this study ethical clearance letter was obtained from institutional review board of Mekelle University, college of health sciences. Permission letters were written for FHRH and Dessie referral hospital. Data were collected after consent of cooperation was obtained from Felege Hiwot referral hospital and Dessie referral hospital administrator.

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Tables

Table 1
Socio-demographic characteristics of preterm low birth weight neonates and their mothers admitted in NICU of Amhara region referral hospitals, Ethiopia, 2019 (*n* = 291).

Characteristics	Category	Total N (%) N = 291	Alive N (%) N = 181	Death N (%) N = 110
Sex of the neonate	Female	106(36.43)	70 (66.04)	36(33.96)
	Male	185(63.57)	111(60)	74(40)
Maternal age (year)	< 20	46(15.81)	29(63.04)	17(36.96)
	20–34	205(70.45)	128(62.44)	77(37.56)
	>=35	40(13.75)	24(62.2)	16(37.8)

Table 2: Maternal medical and obstetrics characteristics of preterm low birth weight neonates and neonatal outcome admitted in NICU of Amhara region referral hospitals, Ethiopia, 2019 (n = 291)

Characteristics		Category	Total N (%) N = 291	AliveN(%) N = 181	Death N(%) N = 110
Maternal chronic Medical disease		No	281(96.56)	178 (63.35)	103(36.65)
		Yes	10(3.44)	3(30)	7(70)
Maternal chronic Medical disease	HIV	No	285(97.94)	179 (62.81)	106(37.19)
		Yes	6(2.06)	2(33.33)	4(66.67)
	DM	No	289(99.31)	181 (62.63)	108 (37.37)
		Yes	2(0.69)	-	2(100)
	Others	No	289(99.31)	180(62.28)	109(37.72)
		Yes	2(0.69)	1(50)	1(50)
Obstetric complications		No	228(78.35)	149(65.35)	79 (34.65)
		Yes	63(21.65)	32(50.79)	31(49.21)
Obstetric complication	PIH	No	246(84.54)	158(64.23)	88(35.77)
		Yes	45(15.46)	23(51.11)	22(48.89)
	placenta-abruption	No	279(95.88)	175 (62.72)	104(37.28)
		Yes	12(4.12)	6(50)	6(50)
	placenta-Previa	No	285(97.94)	178(62.46)	107(37.54)
		Yes	12(2.06)	6(50)	6(50)

Table.3: medical and surgical morbidity related factors of preterm low birthweight neonates admitted in NICU of Amhara region referral hospitals, Ethiopia, 2019 (n = 291).

Morbidity characteristics	Category	Total N(%) N = 291	Alive N(%) N = 181	Death N(%) N = 110
Sepsis	No	90(30.93)	69(76.67)	21(23.33)
	Yes	201(69.07)	112(55.72)	89(44.28)
RDS	No	146(50.17)	115(78.77)	31(21.23)
	Yes	145(49.83)	66 (45.52)	79(54.48)
Jaundice	No	251(86.6)	159(63.10)	93 (36.90)
	Yes	39(13.4)	22(56.41)	17(43.59)
Congenital anomaly	No	267(91.75)	170(63.67)	97(36.33)
	Yes	24(8.25)	11(45.83)	13(54.17)
Hypoglycemia	No	270(92.78)	172(63.7)	98(36.30)
	Yes	21(7.22)	9(42.86)	12(57.14)
Hypothermia	No	72(24.74)	50(69.44)	22(30.56)
	Yes	219(75.26)	131(59.82)	88(40.18)
Perinatal asphyxia	No	284(97.59)	181(63.73)	103(36.27)
	Yes	7(2.41)	-	7(100)
Meningitis	No	268(92.1)	167(62.31)	101(37.69)
	Yes	23(7.90)	14(60.87)	9(39.13)
Necrotizing enter colitis	No	281(96.56)	179 (63.7)	102(36.3)
	Yes	10(3.44)	2(20)	8(80)

Table.4: Neonatal related characteristics of preterm low birthweight neonates and neonatal outcome admitted in NICU of Amhara region referral hospitals, Ethiopia, 2019 (*n* = 291).

characteristics	Category	Total N (%) N = 291	Alive N (%) N = 281	Death N (%) N = 110
Place of delivery	Health institution	273(93.81)	171(62.64)	102(37.36)
	Home	18(6.19)	10(55.56)	8(44.44)
Mode of delivery	Cesarean	59(20.27)	43(72.88)	16 (27.12)
	Vaginal	232(79.73)	138(59.48)	94(40.52)
Type of pregnancy	Single	185(63.57)	118(63.78)	67(36.22)
	Multiple	106(36.43)	63(59.43)	43(40.57)
APGAR score 1st min.	< 7 ≥7	219(80.22) 54(19.78)	129(58.9) 42(77.78)	190(41.1) 12(22.22)
APGAR score 5th min.	< 7 ≥7	121(44.32) 152(55.68)	65(53.72) 106(69.74)	56(46.28) 46(30.26)

Table.5: factors associated with preterm low birthweight neonatal mortality of admitted in NICU of Amhara region referral hospitals, Ethiopia, 2019 (*n* = 291).

Characteristics	Category	Alive	Death	COR(95%CI)	AOR(95% CI)	P> z
Sepsis	No	69	21	1	1	
	Yes	112	89	2.61(1.49–4.58)	2.06(1.05–4.02)	0.035**
RDS	No	115	31	1	1	
	Yes	66	79	4.44(2.66–7.42)	3.28(1.81–5.95)	0.000**
Congenital anomaly	No	170	97	1	1	
	Yes	11	13	2.07(.89-4.81)	3.14(1.16–8.54)	0.025**
Hypoglycemia	No	172	98	1	1	
	Yes	9	12	2.34(.95-5.75)	3.81(1.27–11.44)	0.017**
Hypothermia	No	50	22	1	1	
	Yes	131	88	1.53(.86 – 2.7)	1.34(.68-2.65)	0.401
PIH	No	158	88	1	1	
	Yes	23	22	1.72(.91-3.26)	1.98(.92-4.25)	0.081
APGAR 1st min.	< 7	129	190	2.44(1.22–4.9)	1.72(.72-4.13)	0.228
	>=7	42	12	1	1	
APGAR 5th min	< 7	65	56	1.99(1.21–3.26)	1.24(.66-2.31)	0.513
	>=7	106	46	1	1	
NB: **=significant at p-value < 0.05 in multivariable analysis, 1 = considered as reference category						