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Original Research Article

Survival till discharge and risk factors of mortality among outborn extremely-low-birth-weight neonates: an experience from Central India

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ABSTRACT

Background: Outborn extremely-low-birth-weight (ELBW) neonates have a poor outcome compared to institutionally born neonates. Objectives were to evaluate the risk factors of outcome in outborn ELBW neonates.

Methods: This prospective cohort study was conducted at a tertiary care institute in central India over 2.5 years. Exclusion criteria included death within one hour of arrival or withdrawal of medical advice. Demographic, maternal, neonatal, and transport characteristics were noted until discharge or death. Survival until discharge status and risk factors of mortality were identified. Statistical significance was determined using Chi-square, Mann-Whitney, and unpaired t-test; and multiple logistic regression models were used to identify independent risk factors of mortality. P<0.05 was considered significant.

Results: Survival-to-discharge rate was 19.9%. On univariate analysis, neonates who had longer transport distance (p=0.04), no communication before transport (p<0.0001), and no treatment during transport (p=0.0003); and neonates with hypoglycemia (p=0.05), delayed capillary refill time (CRT) (p=0.01), low oxygen saturation (p<0.0001), and hypothermia (p<0.0001) had risk factors of mortality. Age at admission (adjusted odds ratio [aOR] 0.97, 95% confidence interval [CI] 0.96-0.99, p=0.0001), hypothermia (aOR 0.036, 95% CI 0.004-0.31, p=0.003), and no communication before transport (aOR 46.95, 95% CI 7.57-291.25, p<0.0001) were the independent risk factors of mortality.

Conclusion: Outborn ELBW neonates face a high mortality rate. Age at admission, hypothermia, and lack of communication before transport were independent risk factors of mortality. The study highlights that clinical stabilization, specifically management of body temperature and improvement in pre-transport care and communication, is vital for increasing survival rates in this vulnerable population.

Keywords: ELBW neonates, Outborn neonates, Transported neonates, Neonatal mortality, Predictors, Survival, Neonatal morbidity

INTRODUCTION

Neonatal health is a reliable yardstick of a country's development. In 2024, the average global neonatal mortality rate (NMR) was 17.2 per 1,000 live births, while in India it was 25, with interstate, interdistrict, and rural–urban inequality.[1-3] Premature and low-birth-weight neonates were more fragile, and the majority (80%) were born in southern Asia and sub-Saharan Africa.[4] Extremely-low-birth-weight (ELBW) neonates comprise 0.7-1.7% of all births; they constitute the greatest proportion in neonatal intensive care unit (NICU) because they are more fragile and have a 100-fold mortality risk as compared to normal-birth-weight neonates.[5,6] In recent decades, outcomes of ELBW neonates have improved globally, but they vary widely across countries and regions. The pooled rate of survival to discharge of ELBW neonates was 18%, 28% and 39% respectively for low, low-middle, and upper-middle-income countries, whereas in India, it varies from 52% to 75.5%.[7-9]

Ideally, ELBW neonates should be born at well-equipped NICU centers, and in-utero transport is ideal; most unexpected perinatal complications cannot always be anticipated, and warrant neonatal transport. In India, in spite of various schemes, 11.4% births are noninstitutional, and a large number of neonates require neonatal transport to tertiary care centers.[2] The neonatal transport system in India is in the initial stage; in many rural and semi-urban areas, it is nonexistent, poorly organized, and underutilized except in the state of Tamil Nadu, where three-quarters of neonates are transported by neonatal ambulance.[10]

NMR in these transported preterm and ELBW neonates is significantly high because they miss the care in "golden hour" and are prone to developing life-threatening complications such as hypothermia, hypoglycemia, hypoxia, seizures, and cyanosis. In the scenario to achieve the target of the Sustainable Development Goal and the goal of the India Newborn Action Plan, improvement in the survival of ELBW neonates is vitally important, especially for the states where NMR is fewer than 15 per 1,000 live births. In Indian literature researchers mainly reported outcomes of inborn ELBW neonates, but few reports exist on outborn transported neonates treated at limited resource facilities. Therefore, this study was planned to evaluate the survival status and risk factors of mortality in outborn transported ELBW neonates.

METHODS

Study design, setting, and population

A cohort of consecutively admitted outborn ELBW neonates (those delivered outside our hospital premises—at home, government/private hospital) was studied at one of the largest tertiary care teaching institutes in central India for a duration of two and a half years (July 2017-December 2019). During the study period, a NICU for outborn neonates was not available; hence, they were treated in separate neonatal cabinets in the general paediatric wards with facilities at the special newborn care unit level. At present, we have a well-equipped special level III NICU for outborn neonates.

All liveborn ELBW referral neonates during the study period were included. Neonates who died within an hour in the emergency department and whose parents left the hospital against medical advice and were not willing to participate in the study were excluded.

A total of 2,813 live neonates were admitted during the study period; 257 were ELBW. Although a total of 257 ELBW neonates were admitted during the study period, we included 171 eligible neonates by applying inclusion and exclusion criteria.

Data collection

The data collection instrument was prepared from existing available literature.[11] A preparatory training session was conducted for residents before collecting data. Data were collected by the on-duty resident by interviewing either parents or available close relatives within 2 hours of hospitalization and were monitored by postgraduate qualified senior residents. Besides the demographic data, maternal information like age, parity, antenatal care, place of birth, mode of delivery, and travel details were recorded. Neonatal clinical variables such as oxygen saturation, capillary refill time (CRT), blood sugar, and temperature were noted upon the arrival of neonates. Temperature was measured by using a digital thermometer placed in the axilla for 2 minutes.

A minimum of two readings was taken, and the lowest temperature reading was recorded. By using a pulse-oximeter on the right upper limb on two occasions and by considering the mean of the two values, oxygen saturation was recorded. Perfusion was assessed by measuring CRT. CRT was measured in each neonate by simultaneously alarming a stopwatch and applying minimal pressure until blanching of the skin occurred; and when skin colour returned to baseline, the stopwatch was stopped. For any reason, if measurement had to be repeated, the next attempt was made after an interval of 30 seconds. Blood sugar was measured using a commercially available instrument (glucometer). Temperature <36-36.4 ºC was mild hypothermia, temp 32-35.9 ºC was moderate hypothermia and severe hypothermia was <32 ºC.

Oxygen saturation ≤90% was considered low oxygen saturation and >90% as normal. CRT >3 seconds was considered as delayed CRT (poor perfusion) and blood sugar <40 mg% was considered as hypoglycemia.[12] Gestational age of neonates was assessed by the last date of menstrual period, antenatal ultrasound documents, and/or New Ballard Scoring method if neonatal age was less than 7 days old.[13] Weight was measured by using a digital electronic weighing scale having minimal error of 10 g at the time of admission. Clinical diagnosis was made by using standard case definitions, and neonates were managed according to the treatment protocol of our hospital and standard treatment guidelines. All the neonates were followed up to discharge or death, and outcome was measured as survival and non-survival; risk factors of mortality were analyzed.

Ethical considerations

We followed the principles of the Declaration of Helsinki while conducting the study. The study was approved by the Institutional Ethics Committee (No. 960/EC/Pharmac/GMC/NGP dated 10/01/2017), and written informed consent was obtained from either or both parents or legal guardian after providing necessary information regarding the study in the vernacular language before enrolling the participants. Confidentiality and anonymity were maintained.

Statistical analysis

Data were coded, cleaned, and entered into a Microsoft Excel sheet and analyzed using STATA version 14.0. Categorical variables were presented as frequencies, percentages, and rates. Continuous variables were presented as mean and standard deviation. The duration of hospital stay was calculated by subtracting the date of death or discharge from the date of hospitalization. Chi-square test, Fisher's exact test, unpaired t-test, and Mann-Whitney test were used for comparison between survival and non-survival. Multiple logistic regression was used to identify significant risk factors of mortality. Adjusted odds ratio (aOR) and 95% confidence interval (CI) were calculated. A $p<0.05$ was considered statistically significant.

RESULTS

A total of 171 ELBW neonates were studied. The male-to-female ratio was 0.94:1, and the majority (90.1%) of them were preterm, singleton. One hundred and twenty (70.2%) were delivered by vaginal route at primary or secondary health care level, and 28 (16.4%) had a weight ≤750 gms at time of admission.

Hypoglycemia, hypothermia, delayed CRT, and low oxygen saturation were noted in 65 (38%), 109 (63.7%), 126 (73.7%), and 83 (48.5%), respectively. Surfactant therapy was needed in 12 (7%) and mechanical ventilation in 14 (8.2%). One hundred and thirty-seven (80.1%) neonates succumbed, whereas 34 (19.9%) ELBW neonates survived (Table 1).

Maternal characteristics

One hundred and seven (62.6%) mothers fell into the age group of 21-25 years, whereas 14 (8.2%) were more than 30 years old. One hundred and eight (63.2%) were primiparous, and previous abortion was noted in 19 (11.1%). Health care facilities were available for 168 (98.3%) mothers, and the majority received antenatal care at the primary and secondary health care levels.

One hundred and fifty-six (91.2%) mothers received adequate antenatal care (>4 ANC visits), and 145 (84.8%) received ANC care by medical officers at either a primary health center (PHC), rural hospital (RH), or district hospital (DH). Maternal anemia was noted in 70 (40.9%) and diabetes in 8 (4.7%) of mothers. Preeclampsia was observed in 35 (20.5%), whereas 28 (16.4%) were eclamptic (Table 2).

Transport characteristics

One hundred and forty-five (84.8%) neonates were referred by a medical officer, and 153 (89.5%) were transported by ambulance, but 94 (55%) were transported without a health assistant.

Median transported distance was 82 km, and median transport duration was 2 hours. Communication prior to transport was noted in 25 (14.6%) cases, whereas only 9 (5.3%) neonates received care during transport (Table 3).

Table 1: Baseline characteristics of participants.

Characteristics	All participants, N (%)
Age at admission (hours)	35.1±50.3
Median (IQR), range	24 (20–30), 1–360
Gender	
Male	83 (48.5)
Female	88 (51.5)
Gestational age (weeks)	33.07±3.2
Extreme preterm	56 (32.7)
Moderate preterm	63 (36.8)
Late preterm	35 (20.5)
Term	9 (5.3)
Post-term	8 (4.7)
Weight (gms)	862.3±102.1
≤750	28 (16.4)
>750	143 (83.6)
Type of neonates	
Twin	19 (11.1)
Singleton	152 (88.9)
Mode of delivery	
Vaginal	120 (70.2)
Caesarean	51 (29.8)
Blood sugar (mg%)	55.5±16.7
Hypoglycemia (≤40mg%)	65 (38)
Serum calcium (mg%)	8.6±0.6
Hypocalcemia (≤7 mg%)	6 (3.5)
Temperature (°C)	35.6±1.5
Mild hypothermia	40 (23.4)
Moderate hypothermia	55 (32.2)
Severe hypothermia	14 (8.2)
Normothermia	62 (36.2)
Capillary refill time (sec)	4.3±1.1
Delayed CRT (>3 sec)	126 (73.7)
Oxygen saturation	91.5±3.2
Hypoxia (≤90%)	83 (48.5)
Interventions	
Bubble CPAP	3 (1.8)
Machine CPAP	3 (1.8)
Mechanical ventilation	14 (8.2)
Vasopressors	3 (1.8)
Surfactant therapy	12 (7.0)
Duration of stay (days)	Median: 3 (2–6)
Outcome	
Survival	34 (19.9)
Died	137 (80.1)

IQR-inter-quartile-range, SD-standard deviation, CRT-capillary refill time, CPAP-continuous positive airway pressure

Table 2: Maternal characteristics of participants.

Variables	All participants, N (%)
Maternal age (years)	24.9±3.8
≤20	8 (4.7)
21–25	107 (62.6)
26–30	42 (24.5)
>30	14 (8.2)
Parity	
Primipara	108 (63.2)
Multipara	63 (36.8)
Previous abortion	19 (11.1)
ANC facilities available (yes)	168 (98.3)
Name of ANC facilities	
Primary health care center	75 (43.8)
Rural hospital	38 (22.2)
District hospital	36 (21.1)
Medical institute	22 (12.9)
ANC care provider	
Trained Dai	9 (5.3)
ASHA	17 (9.9)
Medical Officer	145 (84.8)
ANC care	
Adequate (>4 visits)	156 (91.2)
Inadequate (≤4 visits)	15 (8.8)
Medical illness	
Anemia	70 (40.9)
Diabetes	8 (4.7)
Hypertension	19 (11.1)
Hypothyroidism	10 (5.9)
Sickle cell disease	1 (0.6)
Heart disease	2 (1.2)
Chronic kidney disease	1 (0.6)
Obstetric illness	
Pre-eclampsia	35 (20.5)
Eclampsia	28 (16.4)
Oligohydramnios	1 (0.6)
Polyhydramnios	6 (3.5)
Intrapartum fever	6 (3.5)
Antepartum hemorrhage	6 (3.5)
Malpresentation	2 (1.2)

ANC-antenatal care

Morbidity and mortality patterns

Sepsis, respiratory distress syndrome, jaundice, birth asphyxia, meconium aspiration syndrome, and malformation were diagnosed in 93 (54.4%), 62 (36.3%), 2 (1.2%), 2 (1.2%), 1 (0.5%), and 3 (1.7%) neonates respectively, whereas pulmonary and intraventricular hemorrhage was noted in 6 (3.5%) and 2 (1.2%) neonates respectively. Among malformations, trachea-esophageal fistula, anencephaly, and diaphragmatic hernia were noted in each neonate. Birth asphyxia, neonatal jaundice, and meconium aspiration syndrome were noted in term neonates. Thirty-four (19.9%) neonates survived until discharge, and 137 (80.1%) died. More than half (72 [52.6%]) of neonates died due to sepsis, followed by respiratory distress syndrome in 51 (37.2%), whereas all neonates with malformation, pulmonary hemorrhage, intraventricular hemorrhage, birth asphyxia, and meconium aspiration syndrome succumbed.

Table 3: Transport characteristics of participants.

Variables	All participants, N (%)
Transport distance (km)	87.5±44.6
Median (IQR), range	82 (60–98), 3–300
Transport duration (hours)	1.9±0.9
Median (IQR), range	2 (1.25–2), 0.25–6.5
Mode of transport	
Ambulance with health assistant	59 (34.5)
Ambulance without health assistant	94 (55)
Private car	8 (4.7)
Auto-rickshaw	4 (2.3)
Public transport	6 (3.5)
Communication before transport (yes)	25 (14.6)
Treatment during transport (yes)	9 (5.3)
Referral person	
Trained Dai	9 (5.3)
Accredited Social Health Activist	17 (9.9)
Medical officer	145 (84.8)

Km-kilometer

Table 4: Univariate analysis of risk factors of mortality.

Variable	Died (n=137) (%)	Survival (n=34) (%)	P value	Statistical test
Age at admission (hours)	24 (15–30)	24 (24–48)	0.02	Z=2.269
Gender				
Male	67 (48.9)	16 (47.1)	0.84	χ^2=0.037
Female	70 (51.1)	18 (52.9)		
Gestational age (weeks)	32.88±3.3	33.82±2.7	0.13	t=1.5215
Pre-term	122 (89.1)	32 (94.1)	0.26	χ^2=2.44
Term	9 (6.6)	0		
Post-term	6 (4.3)	2 (5.9)		
Weight (gms)	855.85±106	891.76±79.6	0.06	t=1.849

Continued.

Variable	Died (n=137) (%)	Survival (n=34) (%)	P value	Statistical test
≤750 g	26 (19)	2 (5.9)	0.06	χ^2=3.4116
>750 g	111 (81)	32 (94.1)		
Maternal age (years)	25.12±3.8	24.17±3.4	0.18	t=-1.323
Parity				
Primipara	82 (59.9)	26 (76.5)	0.07	χ^2=3.23
Multipara	55 (40.1)	8 (23.5)		
Mode of delivery				
Vaginal	97 (70.8)	23 (67.7)	0.71	χ^2=0.13
Caesarean	40 (29.2)	11 (32.3)		
ANC care				
Adequate	125 (91.2)	31 (91.2)	0.99	χ^2=0.00
Inadequate	12 (8.8)	3 (8.8)		
Transport distance (km)	85 (67–98)	67 (55.3–88.8)	0.04	Z=2.014
Transport time (hours)	2 (1.25–2)	1.37 (1.25–2)	0.11	Z=1.590
Referral person				
Trained Dai	9 (6.6)	0	0.41	χ^2=2.1775
ASHA	13 (9.5)	4 (11.8)		
Medical officer	115 (83.9)	30 (88.2)		
Communication before transport				
Yes	8 (5.8)	17 (50)	<0.0001	χ^2=42.56
No	129 (94.2)	17 (50)		
Treatment during transport				
Yes	3 (2.2)	6 (17.7)	0.0003	χ^2=13.05
No	134 (97.8)	28 (82.3)		
Type of neonate				
Singleton	120 (87.6)	32 (94.1)	0.93	χ^2=0.0069
Twin	17 (12.4)	2 (5.9)		
Previous abortion				
Yes	15 (10.9)	4 (11.8)	0.88	χ^2=0.02
No	122 (89.1)	30 (88.2)		
Mode of transport				
Ambulance + HA	41 (29.9)	18 (52.9)	0.11	χ^2=7.4791
Ambulance − HA	80 (58.4)	14 (41.2)		
Private car	7 (5.1)	1 (2.9)		
Auto-rickshaw	3 (2.2)	1 (2.9)		
Public transport	6 (4.4)	0		
ANC provider				
Trained Dai	9 (6.6)	0	0.07	χ^2=5.0782
ASHA	16 (11.7)	1 (2.9)		
Medical officer	112 (81.7)	33 (97.1)		
Blood sugar (mg%)	53.6±15.7	63.2±18.7	0.002	t=3.0819
≤40 mg%	57 (41.6)	8 (23.5)	0.05	χ^2=3.78
>40 mg%	80 (58.4)	26 (76.5)		
Serum calcium (mg%)	8.6±0.6	8.6±0.7	0.72	t=0.3549
Temperature (°C)	35.3±1.6	36.6±0.2		
Mild hypothermia	33 (24.1)	7 (20.6)	<0.0001	t=4.6112
Moderate hypothermia	55 (40.2)	0		
Severe hypothermia	14 (10.2)	0		
Normothermia	35 (25.5)	27 (79.4)		
Capillary refill time (sec)	4.5±1.1	3.2±0.7	<0.0001	t=-6.9160
≤3	23 (16.8)	12 (35.3)	0.01	χ^2=5.73
>3	114 (83.2)	22 (64.7)		
Oxygen saturation (%)	90.9±3.2	93.8±2.1	<0.0001	t=5.139
≤90	79 (57.7)	4 (11.8)	<0.0001	χ^2=22.8404

Continued.

Variable	Died (n=137) (%)	Survival (n=34) (%)	P value	Statistical test
>90	58 (42.3)	30 (88.2)		
Duration of hospital stay (days)	2 (1–4)	11 (6–39.75)	<0.0001	Z=6.542

IQR-inter-quartile range, SD-standard deviation, ANC-antenatal care, ASHA-Accredited Social Health Activist, HA-Health Assistant.

Table 5: Independent risk factors of mortality (mult-regression analysis).

Risk factors	aOR	95% confidence Interval	P value
Age at admission	0.97	0.96-0.99	0.0001
Duration of stay	0.71	0.59-0.85	<0.001
Hypothermia	0.036	0.004-0.31	0.003
Communication before transport	46.95	7.57-291.25	<0.0001

Risk factors of mortality

On univariate analysis, for neonates, long transport distance (p=0.04), no communication before transport (p<0.0001), and no treatment during transport (p=0.0003) were the risk factors of mortality. Hypoglycemia (p=0.05), delayed CRT (p=0.01), low oxygen saturation (p<0.0001), and hypothermia (p<0.0001) were other risk factors of mortality (Table 4). Age at admission (aOR 0.97, 95% CI 0.96-0.99, p=0.0001), hypothermia (aOR 0.036, 95% CI 0.004-0.31, p=0.003), and no communication before transport (aOR 46.95, 95% CI 7.57-291.25, p<0.0001) were the independent risk factors of mortality (Table 5). The median duration of hospital stay was statistically significantly shorter (2 days) in non-surviving neonates compared to surviving neonates (11 days) (p<0.0001).

DISCUSSION

During the study period, a total of 2,813 live neonates were admitted; 257 (9.1%) were ELBW, which is far higher than reported in the literature.[5,6] It might be due to our institute being one of the largest referral tertiary care government facilities, catering to a huge population.

In this study, 90% of neonates were preterm, including 32.7% who were extreme preterm, and 83.6% had a weight >750 gms on admission. There was no significant difference in mean gestational age (GA) (p=0.13) and weight on admission (p=0.06) of surviving and non-surviving neonates, probably because the majority of them were intra-uterine growth restricted neonates. However, various researchers revealed a significantly higher chance of mortality in lower gestation and decreased birth weight neonates.[9,14,15] We noted that females were outnumbered compared to males, which might be due to gender discrimination in society and cheaper treatment options for female neonates.[16] We did not find a significant relationship between gender and mortality; our findings are consistent with the observations of Alhasoon et al.[6] Few researchers noted that males have a higher chance of death, whereas some authors noted a significant association with mortality in female neonates.[15,17]

An increase in the incidence of ELBW neonates may be partly related to the prevalence of multiple pregnancies, mostly as a consequence of the assisted reproduction program. We noted that 11.1% of neonates were multiple births, and 70.2% were delivered by vaginal route at either home, primary, or secondary health care level. There was no significant difference in mortality between mode of delivery and type of neonate, and our findings are in agreement with the other research, although a few authors noted that cesarean mode of delivery is protective for ELBW neonates compared to vaginal delivery.[14,15,17,18] Preterm birth complications can be prevented by early identification of high-risk mothers through effective antenatal care. In this study, although ANC facilities were available for 98.3% of mothers, 8.8% were inadequately supervised, and in 15.2% of mothers, ANC care was provided by paramedical staff. Association of such antenatal care factors, utilization of health care services, and golden hour management affect the survival of neonates as reported by researchers, but we could not find an association of utilization of ANC care and mortality of ELBW neonates, although Vilanova et al revealed that lack of prenatal care and birth in public hospitals are determinants of mortality in LBW infants.[17,19,20]

Adolescence, advanced age of mother, and increased parity have detrimental effects on perinatal outcome. In this study, 4.68% and 8.19% of mothers were adolescents and aged >30 years, respectively, whereas 36.84% were multipara. Deeply rooted religious customs, inadequate sex education, and audiovisual media have more impact on adolescents' pregnancy, whereas increased maternal age in the Indian scenario might be due to focusing on girls' education, uncertainty in income source, and late marriages. In this study, anemia was most common (40.9%), followed by hypertension in 11.1% of mothers, and preeclampsia was the most common obstetric illness, whereas previous abortion was noted in 19 (11.11%). There was no significant relation between the mortality of ELBW neonates and maternal age, parity, maternal illness, and obstetric complications. Literature suggests that premature rupture of membrane more than 18 hours, chorioamnionitis, perinatal anemia, and pregnancy-induced hypertension are associated with higher mortality in ELBW neonates, because they are primarily responsible for prematurity and infection.[6,14,18]

Institutional delivery and in-utero transport of neonates improve the outcome of outborn neonates. In spite of various measures by the government, in India, neonatal transport is mostly not prioritized, and neonates are transported either through hospital ambulance without a health assistant, private ambulance, or personal mode of transport without stabilization and proper care during transport, resulting in high mortality.[21] In this study, all neonates were referred by government health care facilities (PHC, RH, DH), and the majority (89.47%) were transported by ambulance, but more than half (54.97%) without a health assistant, providing no or poor care during transport, and no communication prior to transport was observed in 14.62% of cases. The median transport distance and duration were 82 km and 2 hours, respectively. It was also observed that mortality was significantly associated with long transport distance (p=0.04), no treatment during transport (p=0.0003), and no communication with the receiver team prior to transport (p<0.0001). Various researchers noted that long traveling distance without proper transport care or communication increases serious neonatal complications and preventable deaths.[22,23]

Transported neonates are more prone to hypothermia, hypoglycemia, hypoxia, shock, and increased incidence of infections due to lack of "golden hour" care.[24-26] In this study, hypoglycemia, hypothermia, delayed CRT, and low oxygen saturation were noted in 65 (38%), 109 (63.7%), 126 (73.7%), and 83 (48.5%) cases, respectively, and mortality was significantly higher in neonates with hypoglycemia, hypothermia, delayed CRT, and low oxygen saturation. Higher mortality in hypothermia might be due to hemodynamic instability and metabolic acidosis. Therefore, prevention and management of hypothermia are key to reducing mortality by forming a multidisciplinary expert team, developing evidence-based interventions, educating hospital staff, using plastic wrap or bags, and using a radiant warmer or incubators.

In this study, sepsis was the most common diagnosis and cause of mortality, followed by respiratory distress syndrome; however, all neonates with pulmonary hemorrhage, intraventricular hemorrhage, and malformations succumbed. Mukhopadhya et al of India observed that sepsis is the predominant cause of mortality in ELBW neonates, followed by perinatal asphyxia and pulmonary hemorrhage. Kayode-Adedeji et al, in a Nigerian study of ELBW neonates, reported jaundice in 84%, respiratory distress syndrome (RDS) in 80%, and sepsis in 28% of neonates, whereas the authors of a Turkish study noted RDS in 85.7%, late onset sepsis in 24% of cases, and pulmonary hemorrhage in 5.5%.[26-28] However, a Chinese author noted that pneumonia is a major cause of morbidity followed by RDS in 86.2% of ELBW neonates.[29]

Although in recent years, survival of preterm ELBW neonates has improved in developed nations, it is worrisome in low- and middle-income countries and remains very low in outborn neonates. The rate of survival until discharge of Turkish ELBW neonates was 54.5% and 76% for those who had birth weight of ≤750 gm and 750-1000 gm respectively, whereas a nationwide dataset of Thai ELBW neonates showed in-hospital mortality of 36.9%.[5,28] The reported mortality rate of Saudi Arabian ELBW infants was 12.9-41%.[6,15,29]

In this study, the survival-until-discharge rate was 19.9% whereas the median duration of non-surviving neonates was significantly less (2 days) compared to those surviving (11 days) (p<0.0001), denoting that non-surviving neonates were critically sick at the time of admission. Similarly to our findings, Kayode-Adedeji et al noted a low (14%) survival rate of outborn neonates compared to 33% in inborn ELBW infants.[27] In India, it has varied from 52-75.5% for inborn neonates; however, isolated data on ELBW outborn neonates are not available.[7,8]

Age at admission (aOR 0.97, 95% CI 0.96-0.99, p=0.0001), hypothermia (aOR 0.036, 95% CI 0.004-0.31, p=0.003), and no communication before transport (aOR 46.95, 95% CI 7.57-291.25, p<0.0001) were the independent risk factors of mortality. Birth weight and GA are the important predictors of survival of ELBW infants, but we could not find a significant correlation with mortality, which might be due to the small sample size. Mukhopadhyay et al reported that birth weight ≤800 gm, mechanical ventilation, and hypotensive shock were the predictors of mortality, whereas inborn neonates, GA ≥28 weeks, birth weight of ≥750 gm, and admission within 2 hours of life were the survival factors for ELBW neonates in a Nigerian study.[26,27]

Alhasoon et al revealed that prolonged rupture of membrane, periventricular leukomalacia, major intraventricular hemorrhage, and longer length of stay were associated with increased risk of non-survival, whereas increased GA, Apgar score, and cesarean section were associated with decreased risk of non-survival.[29]

Authors of a multicenter study in China found that birth weight, GA, regional economic development, and type of hospital were influencing factors for the survival rate of ELBW neonates.[18,30]

CONCLUSION

Outborn ELBW neonates face a high fatality rate with a survival-to-discharge rate of 19.9% found in this study. Age at admission, hypothermia, and no communication before transport were the independent risk factors of mortality. The study highlights the importance of clinical stabilization; specifically, managing body temperature and improving logistical coordination (pre-transport communication) are vital for increasing survival rates in this vulnerable population.

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