Original Article

Determinants of survival of extremely low birth weight infants in a rural Nigerian Hospital

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Abstract

Background: Over 90% of the neonatal deaths occur in low- and middle-income countries, mostly in sub-Saharan Africa, including Nigeria. Prematurity is related to more than one-third of these deaths on a global scale; with the extremely low birth weight (ELBW) category having a 100-fold mortality risk compared to the normal birth weight infants. **Objective:** The purpose of this study was to determine the survival rates of ELBW infants and to identify the factors associated with survival in a rural hospital in Nigeria. **Materials and Methods:** All the neonates admitted to the unit weighing <1000 g at admission were enrolled. The birth place, gender, gestational age (GA), birth weight, postnatal age, temperature, blood sugar at admission, and outcome were documented. None of the babies received surfactant or assisted ventilation. **Results:** 29 out of 992 neonates (3%) admitted to the neonatal unit over the study period were ELBW. The survival rates of the inborn and outborn neonates were 33% and 14%, respectively. **Conclusions:** Factors associated with increased survival were inborn, GA ≥28 weeks, birth weight of 750 g, inborn and admission within 2 h of life.

Key words: *Birth weight, Extreme, Neonates, Preterm, Survival*

Preterm deliveries account for 60-75% of the perinatal mortality worldwide [1,2]. Prematurity is related to 40-60% of these deaths; with the extremely low birth weight (ELBW) category having a 100-fold mortality risk compared to the normal birth weight infants [3,4]. There has been a significant improvement in outcome of premature infants in developed countries over the past three decades [5-7]. Factors that have contributed to the improved survival include the use of antenatal steroids, surfactant therapy, and mechanical ventilation [8,9]. The same, however, cannot be said of developing countries where all these facilities may not be available at every setup [10-12]. The purpose of this study was to determine the survival rates of ELBW infants and to identify the factors associated with the survival.

MATERIALS AND METHODS

The study was done at the special care baby unit (SCBU) of Irrua Specialist Teaching Hospital, located along the Benin-Abuja expressway in Irrua, Esan Central Local Government Area (ECLGA), Edo State, Nigeria. Irrua is a rural setting and has a projected population of 129,421. The SCBU has a capacity for 26 neonates; with an average annual admission rate of 500. The facilities available include incubators, cots, and phototherapy units. There are no facilities for parenteral nutrition, surfactant administration, or assisted ventilation beyond intranasal oxygen administration. Specialist and resident pediatricians, as well as pediatric and general nurses, are attending the babies.

It was a retrospective study conducted over a period of 2-year (January 2008-December 2009). Data was obtained from the patient's case notes for all the neonates admitted to the unit weighing <1000 g at admission. The information extracted for all neonates includes the birth place, gender, gestational age (GA), birth weight, postnatal age, temperature, and blood sugar at admission. Information on APGAR scores and antenatal steroids was available for inborn infants only. Maternal risk factors such as premature rupture of membrane, peripartum fever, and antepartum hemorrhage were documented wherever available.

Results of the investigations were also noted. As per hospital policy, blood sugar, complete blood count, and micro erythrocyte sedimentation rate were done for all patients routinely. Other investigations such as electrolytes, radiograghy, and bilirubin estimation were done as and when indicated. In addition, morbidities, duration of hospitalization, and outcome were also documented. The outcome was classified as died or survived.

Data analysis was done using the SPSS version 20 and Microsoft Excel 2007 version. Overall survival rate and

stratified survival rates by GA and birth weight were calculated. Chi-square test was used to test an association between risk factors and the survival outcome at a statistical significance level of 0.05.

RESULTS

29 out of 992 neonates (3%) admitted to the SCBU over the two-year period were ELBW. Out of these, 15 (52%) were inborn while 14 (47%) were outborn. There were 2210 live births in the hospital during this period, putting the incidence rate of ELBW at 7.2/1000 live births. 17 (58.6%) of the neonates were male while 12 (41.3%) were female. Seven (24%) of the infants survived, 21 died and one discharged against medical advice. The duration of hospitalization for discharged neonates ranged from 69 to 92 days with a mean of 81.4 days. Table 1 shows the physical features of the infants at admission.

Fig. 1 shows that there were no survivors with birth weight <750 g with the highest survival in the 950 g category. The figure did not reflect the increasing survival with increasing GA; although, the numbers were too small to draw a valid conclusion. Table 2 reveals that inborn neonates had almost 2.5-fold survival compared to the outborn, while admission within 2 h of birth conferred a four-fold survival advantage.

GA was most closely associated with survival; although, this relationship did not attain statistical significance. Survival was highest in neonates with GA ≥28 weeks while 100% mortality was seen in infants below 26 weeks of gestation. Table 3 shows that majority of the infants had significant jaundice, respiratory distress syndrome (RDS) and episodes of hypothermia, and blood sugar abnormalities. Clinical Sepsis was recorded in 28% of the neonates, with almost equal cases of early and late onset neonatal sepsis. Out of the 21 fatalities, 12 (57%) were early neonatal deaths (ENND) and nine (43%) were in the late neonatal period. RDS accounted for 11 (92%) of the ENND while sepsis accounted for all the fatalities in the late neonatal period. The contribution of intraventricular hemorrhage (IVH) to the deaths was difficult to ascertain because trans fontanelle ultrasonography (USG) was not routinely done, and a post-mortem examination was also not carried out.

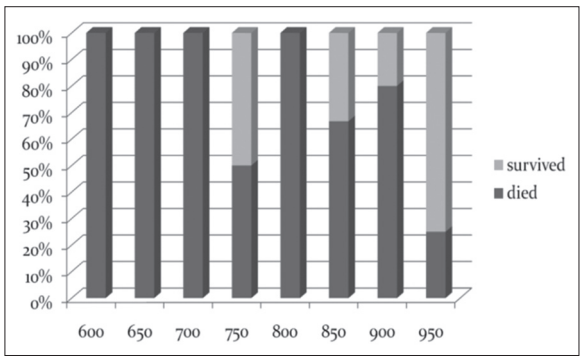

Figure 1: Outcome of patients based on birth weight

DISCUSSION

Low birth weight infants contribute significantly to childhood morbidity and mortality [1-3]. The contribution of ELBW to neonatal admissions is usually very small; however, they have the longest hospital stay and require intensive care facilities and neonatal specialist care more than other neonates. In this study, ELBW constituted 3% of neonates admitted to the neonatal unit. This was higher than the ELBW of 1%, 1.07%, and 1.9% recorded by Trotman and Lord, Narayan et al., and Okoji and Oruamabo, respectively [12-14]. This higher number could have been related to the involvement of women in farming activities in this predominantly agrarian rural community which may predispose to preterm labor. In addition, there was no other health facility equipped to care for extreme preterm neonates in the locality.

The survival rate of the inborn neonates in this study was 33%, none of whom received surfactant or assisted ventilation.

Table 1: Physical characteristics of the subjects

Parameter	Mean±SD	Range
GA (weeks)	26.8±1.6	24-29.8
Birth weight (g)	816±105	600-950
Age at admission (h)	2.8±4.9	0.1-20
Temperature at admission (°C)	35.2±0.5	35-36.9
Blood sugar at admission (mmol/L)	2.9±1.8	0.7-8.7

GA: Gestational age, SD: Standard deviation

Table 2: Outcome based on birth place, GA and postnatal age on admission

Variable	Frequency	Percentage survival	p
Birth place			0.445
Inborn	15	33	
Outborn	14	14	
GA (weeks)			0.066
24-25.9	7	0	
26-27.9	12	25	
28-29.9	10	40	
Postnatal age (h)			0.218
≤2	17	35	
>2	12	9	

GA: Gestational age

Table 3: Frequency of observed morbidities

Morbidity	Percentage
Jaundice	84
RDS	80
Hypothermia	69
Hypo/hyperglycemia	59
Anemia (requiring transfusion)	41
Sepsis	28

RDS: Respiratory distress syndrome

This was similar to the 32% survival rate reported by Velaphi et al. in South Africa, higher than the 12% and 10% reported by Ali in Trinidad/Tobago and Okoji and Oruamabo in Port-Harcourt, Nigeria, respectively, where there was limited or no access to surfactants [14-16]. However, this survival rate was less than that reported from India and Jamaica (52% and 47%, respectively), where surfactant administration and mechanical ventilation were part of the routine care [11,12].

In our study, birth weight of 750 g or more was associated with higher survival rates which was comparable with the results of other studies conducted in resource-poor settings [11,13,15]. The relationship between birth weight and the outcome is more likely to be related to the GA, and an inverse relationship exists between GA and survival rate of ELBW. We observed the highest mortality for babies delivered at GA ≤26 weeks and the highest survival in babies' ≥28 weeks. This was similar to findings by Suthida et al, Trotman and Lord, and Shankar et al [11-13]. This is not unexpected, as the alveolar phase of lung development commences at 26 weeks of gestation. Therefore, severe RDS would be the most common cause of early neonatal mortality in these neonates and survival is highly unlikely without exogenous surfactant administration and mechanical ventilation [17].

14% of outborn neonates in this study survived compared to 33% of the inborn. The reasons for higher mortality in these neonates are quite obvious: Acute complications such as hypothermia, hypoglycemia, apnea, IVH, and infections are likely to have occurred due to delayed presentation and poor transport conditions. It can also explain the lower survival among those admitted after 2 h of birth. The use of antenatal steroid may also have improved the survival of inborn neonates. These findings are therefore not entirely surprising as preterm neonates are best transported in-utero.

Similar to findings by Shankar et al., RDS and hyperbilirubinemia were among the most prevalent morbidities documented among ELBW [13]. The contribution of RDS to mortality in this cohort emphasizes the significant role of surfactant administration and mechanical ventilation to the survival of extreme preterms. In developed countries where there is almost universal access to mechanical ventilation, surfactant administration and parental nutrition, survival rates as high as 40-55% for neonates weighing 601-750 g and 60-85% for those weighing 751-1000 g, have been documented [7,8].

The prolonged duration of admission of these neonates constitutes an enormous financial challenge for the parents. The average duration of admission was 81 days for the ELBW neonates who survived in this study; this is due to poor weight gain. This is not unrelated to the lack of parenteral nutrition. In addition to poor weight gain, the neonates are also at increased risk of neonatal hypocalcemia and micronutrient deficiencies [18]. Problems associated with prolonged hospitalization are nosocomial infections, caregiver burnout, and lack of space to admit other neonates.

While the provision of sophisticated equipment are crucial to the improvement of neonatal outcome in the long term, there is a need to adapt low-cost technology, improve antenatal care services aimed at preventing preterm delivery, health seeking practices, and referral practices to achieve progress in the immediate period in resource-limited environments. The use of improvised bubble continuous positive airway pressure may be an effective, low-cost intervention for respiratory support to improve survival [19]. It is also imperative to stress the need to strengthen and escalate health insurance schemes in Nigeria, especially in rural and suburban areas like our locale so that the prolonged treatment of these preterm neonates can be taken care off.

The limitations of our study include the small number of ELBW described, the unavailability facilities for investigations such as blood gases, blood culture, and transfontanelle USG as well as unavailability of modern treatment modalities such as surfactant and mechanical ventilation.

CONCLUSION

This report shows that in spite of limited resources and access to neonatal intensive care facilities, a decent survival rate can be achieved for babies up to 28 weeks GA weighing up to 750 g.

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