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Survival rate and length of stay of preterm babies less than 1500 grams in a neonatal unit in Port Harcourt, Nigeria

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ABSTRACT

Background: The survival rate and length of stay of preterm babies which is usually of concern to both parents and clinicians is critical in counselling parents at the time of admission and also assesses the efficiency of the neonatal unit thus necessitating the present study.

Methods: A prospective study carried out over 30 months in the neonatal unit of Rivers State University Teaching Hospital, Nigeria.

Results: Of 115 preterm babies <1500 gm studied, commonest gestational age and birth weight were 30 weeks 25 (21.7%) and 1000-1199 gm, 35 (30.4%) respectively. There were 100% survival rates for preterms delivered at 31 weeks, 33 weeks, 34 weeks and 36 weeks gestation; 0% survival at 25 weeks and 25% at 24 weeks and 26 weeks gestation. Survival rate was highest among birth weight 1400-1499 gm (89.2%) and lowest with birth weight <1000 gm (30.4%). Length of stay was longest with gestational age of 24 weeks (62.00±0.00 days) and birth weight <1000 gm (57.71±9.96 days) and shortest for gestational age of 35 weeks (20.00±0.00 days) and birth weights 1400-1499 gm (31.92±12.12 days). Survival status was significantly associated with gestational age and birth weight, p value <0.0001. Preterms with early onset sepsis and severe anaemia were significantly associated with length of stay, p value <0.05.

Conclusions: The survival rate of preterms <1500 gm increase with increasing gestational age and birth weights while the length of stay increase with decreasing gestational age and birth weight. These findings will therefore form part of the counselling given to parents/caregivers during admission of their preterm babies.

Keywords: Length of stay, Preterms, Survival rates

INTRODUCTION

An estimated 15 million babies are born before 37 completed weeks of gestation yearly and this number is on the increase according to world Health Organization. More than 60% of preterm births take place in Africa and South Asia although it is a global problem. Nigeria ranks third out of ten countries with the greatest burden of preterm births with India being the first and Brazil the tenth. Complications of preterm births are the leading causes of death among children below 5 years globally. It is pertinent to note that the survival rate of these babies differ around the world. About half of the babies born at or below 32 weeks gestation die in low income countries

due to lack of feasible cost effective care such as warmth, breastfeeding support as well as basic care for infections and breathing difficulties.¹ Majority of these babies however survive in high income countries.²

The survival and length of stay (LOS) of preterm babies are usually of concern to both parents/caregivers and the health care providers and appear to vary in different neonatal units and countries. Parents/caregivers are usually worried about the LOS of their preterm babies shortly after admission. In the past, staff of neonatal units used the expected date of delivery (EDD) as the expected date of discharge of these preterms.³ There is however documented evidence that moderately preterm infants

were discharged earlier than their expected dates of deliveries. 4.5 Estimation of the LOS is thus vital in counselling such parents/caregivers and thereby preparing them psychologically.

Preterm babies tend to have a prolonged LOS when compared to term babies as they may require several weeks to months of specialised neonatal care such as incubator care, mechanical ventilation, surfactant therapy, Continuous positive airway pressure (CPAP) etc. With the advancement of prenatal and neonatal care leading to increased survival of these preterm babies, there is thus an increased length of stay observed in these preterms.⁶ Length of hospital stay of preterms is influenced mainly by their gestational age, birth weights and the underlying medical conditions such as persistent apnoeic attacks, bronchopulmonary dysplasia, neonatal sepsis, necrotizing enterocolitis and prolonged tube feeding.^{7,8} Varying discharge policies of neonatal units, unavailability of incubators and the practice of kangaroo mother care also influence the LOS of preterm babies in the hospital.

Prolonged LOS leads to increased risk for nosocomial infections in the babies and lack of bonding between the baby and the mother whereas there is increased financial burden on families and communities as well as strain on the family and work for the parents.³ It also increases the strain on the staff and health care system with reduced bed space thereby limiting the admission of other preterm babies into the unit. Studies have shown a close relationship between the cost of neonatal care and the length of hospital stay.^{9,10}

The present study was therefore carried out to evaluate the survival rate, length of stay as well as factors influencing the LOS of preterm babies less than 1500 gm in a neonatal unit in Port Harcourt, Nigeria as only very few studies of this kind has been carried out in Nigeria and none in Port Harcourt. Findings from this study would form part of the counselling given to parent/caregivers during admission of their babies as well as assess the efficiency of the neonatal care in Port Harcourt, Nigeria.

METHODS

A prospective study of all inborn preterm babies less than 1500 gm admitted into the neonatal unit of the Rivers State University Teaching Hospital (RSUTH) was carried out over a 30 months' period from June 2017 to December 2019. The Rivers State University Teaching Hospital (RSUTH), one of the 2 tertiary hospitals in Rivers State is state owned. It is a 375 bedded hospital and serve as referral centre for all the primary health centres, general hospitals owned by the state as well as private owned hospitals and health facilities in neighbouring states.

The neonatal unit which is run for by 2 consultant Paediatricians, resident doctors with a nurse: patient ratio

of 4:1 consist of an inborn and outborn unit. The inborn unit which admits all babies of mothers who had antenatal care and delivery in RSUTH or any of the primary health centres and general hospitals consist of 7 functional incubators, 10 phototherapy machines, 2 resuscitaire as well as oxygen cylinders and oxygen concentrators whereas the outborn unit which is a much smaller unit admits babies whose mothers did not have antenatal care and delivery in the RSUTH, primary health care or general hospitals as well as babies of mothers who delivered in RSUTH but did not undergo antenatal care in RSUTH or any of the government hospitals. The outborn unit consist of 3 incubators, 4 phototherapy machines, a resuscitaire, oxygen cylinders and oxygen concentrators. The neonatal unit does not however have sophisticated equipment like mechanical ventilators, continuous positive airway pressure (CPAP) machines, blood gas analysers etc.

Ethical approval was obtained from the Rivers State Health Research Ethics Committee before commencement of the study while informed consent was obtained from parents/caregivers before recruitment.

Inclusion criteria

All live inborn preterm babies with birth weights less than 1500 gm admitted into the inborn neonatal unit and whose parents/caregivers gave consent.

Exclusion criteria

Preterm babies with birth weights 1500 gm and above, babies dead on arrival and preterm babies whose parents/caregivers did not give consent were excluded from the study. Re-admitted preterm babies <1500 gm were also excluded from the study.

A pre-designed proforma was used to record information about the mothers and the babies. Maternal information documented included age, use of antenatal steroids and immunodeficiency virus (HIV) Information about the babies included the sex, mode of delivery, gestational age, birth weights, diagnosis made, outcome and length of stay of discharged babies. The gestational ages of the babies were calculated using the first day of the last menstrual period or result of the first trimester abdominal ultrasound scan. All recruited babies were weighed on arrival in the neonatal unit using a Seca electronic weighing scale and weights repeated three times weekly (Mondays-Wednesdays-Fridays) until child was either discharged home, discharged against medical advice, referred or died. The scale was set at 0.00 and babies were weighed undressed. Clinical diagnosis was made based on the unit protocols with the support of laboratory investigations where indicated. The length of stay was calculated as the number of days from admission to discharge. The criteria for discharge included all preterms with weights ≥1600 gm, clinically stable, breathing at room air with no respiratory support, packed cell volume ≥34%, feeding well by mouth via cup and spoon, maintaining normal body temperature in the open ward and consistent weight gain. Kangaroo mother care (KMC) was a usual practice in the neonatal unit for all preterm babies who had attained a weight of 1500 gm in stable clinical condition.

All the data was entered into a Microsoft Excel spread sheet and analysed using SPSS version 23. The distribution of gestational age and birth weights by length of stay was derived by obtaining the mean and standard deviation of each category of the variable. The relationship between gestational age and length of stay and birth weight was derived by correlation statistics showing the correlation coefficient of the distribution.

Student T-test was employed in obtaining the statistics for the association between survival status and gestational age and birth weights. The P value was placed at <0.05. One-way ANOVA was employed in cases where the categories of a variable were more than two. Student T-test was considered most appropriate test statistics to determine the association between length of stay and morbidity pattern and other selected factors. Fishers' Exact Test was used in determining the statistical significance in the association between survival status and gestational age and birth weights.

RESULTS

Distribution of gestational age and survival rate of preterm babies <1500 gm

Of 115 preterm babies less than 1500 gm admitted into the neonatal unit, the commonest gestational age observed was 30 weeks, 25 (21.7%) followed by 28 weeks, 24 (20.9%), 32 weeks, 13 (11.3%) and 29 weeks (11.3%) while the least was 25 weeks, 1 (0.9%). The mean gestational age was 29.52±3.55 weeks.

Table 1: Distribution of gestational age and survival rate of preterm babies <1500 gm.

Gestational	Frequency,	Surviva	l status	Survival
age (weeks)	n=115 (%)	Alive	Dead	rate (%)
24	4 (3.5)	1	3	25.0
25	1 (0.9)	0	1	0.0
26	8 (7.0)	2	6	25.0
27	7 (6.1)	4	3	57.1
28	24 (20.9)	12	12	50.0
29	13 (11.3)	8	5	61.5
30	25 (21.7)	19	6	76.0
31	6 (5.2)	6	0	100.0
32	13 (11.3)	10	3	76.9
33	6 (5.2)	6	6	100.0
34	4 (3.5)	4	0	100.0
35	2 (1.7)	1	1	50.0
36	2 (1.7)	2	0	100.0

The survival rate was 100% for preterms born at gestational ages of 31 weeks, 33 weeks, 34 weeks and 36 weeks whereas there was no survival at gestational age of 25 weeks while 25% survival rate was observed for preterms born at gestational ages of 24 weeks and 26 weeks (Table 1).

Distribution of birth weight and survival rate of preterm babies <1500 gm

The commonest birth weights observed in preterms less than 1500 gm was 1000-1199 gm (30.4%) followed by 1400-1499 gm (24.3%) while the least was 1200-1299 gm, 14 (12.2%). The mean birth weight was 1140 ± 230 gm.

Table 2: Distribution of birth weight and survival rate of preterm babies <1500 gm.

Birth weight	Frequency,	Survival status		Survival
(gm)	n=115 (%)	Alive	Dead	rate (%)
<1000	23 (20.1)	7	16	30.4
1000-1199	35 (30.4)	23	12	65.7
1200-1299	14 (12.2)	10	4	71.4
1300-1399	15 (13.0)	10	5	66.7
1400-1499	28 (24.3)	25	3	89.2

The survival rate was highest among birth weights 1400-1499 gm (89.2%) followed by preterms with birth weights 1200-1299 gm (71.4%) while the least were preterms with birth weights <1000 gm (30.4%) (Table 2).

Length of stay according to gestational age

The mean length of stay of preterms less than 1500 gm increased with decreasing gestational age with the longest mean length of stay observed among preterms with gestational age of 24 weeks $(62.00\pm00.00 \text{ days})$ and the lowest among preterms with gestational age of 35 weeks $(20.00\pm00.00 \text{ days})$ (Table 3).

Table 3: Length of stay according to gestational age.

Gestational age (weeks)	Length of stay; mean±SD (days)
24	62.00±00.00
25	0
26	57.50±10.61
27	60.75±12.20
28	53.75±12.53
29	47.75±16.28
30	43.42±15.84
31	28.17±18.14
32	40.10±14.99
33	37.17±9.91
34	50.00±0.00
35	20.00±0.00
36	31.00±1.41

Length of stay according to birth weight

The mean length of stay of preterms less than 1500 gm increased with decreasing birth weights. The longest mean length of stay was observed among preterms with birth weight <1000 gm $(57.71\pm9.96$ days) while the least length of stay was observed among preterms 1400-1499 gm $(31.92\pm12.02$ days) (Table 4).

Association between survival status, gestational age and birth weight

The survival status of preterms less than 1500 gm was significantly associated with gestational age and birth weight, p value <0.0001 (Table 5).

Association between length of stay and morbidity pattern of preterms <1500 gm

Preterms less than 1500 gm with early onset sepsis (p value =0.003) and severe anaemia (p value <0.0001) were significantly associated with length of stay. Neonates with various morbidities however had a longer length of stay than those without morbidities (Table 6).

Association between length of stay, demographic characteristics and other factors

There was no statistical significance in the association between the length of stay, infants' demographic characteristics, maternal HIV status and maternal antenatal steroid use, p value >0.05 (Table 7).

Table 4: Length of stay according to birth weight.

Birth weight (kg)	Length of stay; mean±SD (days)
<1000	57.71±9.96
1000-1199	54.39±11.96
1200-1299	55.00±18.30
1300-1399	34.40±10.69
1400-1499	31.92±12.02

Table 5: Association between survival status, gestational age and birth weight.

Variables	Survival status (mean±SD)		Test of significance	
	Alive	Dead	T test	P value
Gestational age	30.25±2.37	28.15±2.32	4.60	<0.0001*
Birth weights	1.20±0.19	1.01±0.23	4.46	<0.0001*

Table 6: Association between length of stay and morbidity pattern of preterms <1500 gm.

Morbidity	Length of stay	TD 4	D 1		
pattern	(mean±SD)	T-test	P value		
Congenital anomalies					
Yes	57.50±38.89	1.102	0.274		
No	44.27±16.22				
Birth asphyx	cia				
Yes	49.12±17.73	1.654	0.105		
No	42.25±15.90				
Hypoglycaen	nia				
Yes	48.32±17.16	1.466	0.148		
No	42.43±16.31				
Jaundice			a		
Yes	46.12±15.62	1.2	Continued.		
No	39.89±19.73				
Early onset s	sepsis				
Yes	50.00±15.97	3.047	0.003*		
No	38.81±15.83				
Haemorrhag					
Yes	70.00±21.21	1.724	0.329		
No	43.93±16.26				
Necrotizing of	enterocolitis				
Yes	54.33±15.95	1.549	0.172		
No	43.78±16.68				
Anaemia					
Yes	50.12±14.90	4.304	<0.0001*		
No	34.27±15.33				
Respiratory distress					
Yes	46.33±16.18	1.942	0.071		
No	35.67±17.67				
Apnea					
Yes	50.92±14.97	1.554	0.139		
No	43.43±16.93				

Table 7: Association between length of stay, demographic characteristics and other factors.

Variables	Length of stay (mean±SD)	T-test	P value		
Sex					
Male	45.74±16.11	0.578	0.565		
Female	43.49±17.56	0.578			
Type of delivery					
SVD	47.34±17.59	1 210	0.195		
CS	42.25±15.85	1.310			
Mothers' HIV status					
Positive	35.00±14.85		0.489		
Negative	45.35±19.50	F=0.723			
Unknown	43.75±19.50				
Antenatal steroid use					
Yes	46.04±16.59	0.800	0.377		
No	42.50±17.09	0.890			

 $SVD = Spontaneous \ vaginal \ delivery, \ CS = Caesarean \ section, \ F = ANOVA \label{eq:spontaneous}$

DISCUSSION

The survival of preterm babies depends not only on the quality of medical care or technological advancement of the neonatal unit but also on the maturity of the preterm. In the present study, the survival rates increased with increasing gestational age with 100% survival rate documented among preterms delivered at 31 weeks, 33 weeks, 34 weeks and 36 weeks gestation. There was no survival of babies delivered at 25 weeks gestation while only 25% survival was recorded for babies delivered at gestational ages of 24 weeks and 26 weeks. Similar finding was observed by Kunle-Olowu et al in Bayelsa, Nigeria who also documented increasing survival rate among preterm babies with increasing gestational age.¹¹ Contrary to the present study however, there was no survival in gestational ages of 24 weeks, 27 weeks and 29 weeks in which the present study recorded 25%, 25% and 57.1% respectively. In addition, the latter study recorded 60% and 78.6% survival rates in preterms delivered at gestational ages of 31 weeks and 34 weeks respectively in which the present study recorded 100%. 11 The much better survival rate reported in the present study could be because it is a more recent study carried out 7 years after the Bayelsa study and may possibly be due to an improved quality of care. 11 It is pertinent to note that the survival rates of preterms <28 weeks gestation in developing countries is still low as seen in the present study ranging between 0-50%. This is as a result of unavailability or very high cost of surfactant therapy, lack of continuous positive airway pressure (CPAP) machines and mechanical ventilators that are readily available in the developed countries.

In the present study, the length of stay increased with reducing gestational age as also observed by Kunle-Olowu et al in Bayelsa Nigeria, Al Johani et al in Saudi Arabia, Seaton et al in the United Kingdom and Armanian et al in Iran.^{7,11-13} Murki et al in their multicentre prospective study in India documented increased length of stay by 9 days for every reduction in gestational age every week.¹⁴ Also, a multicentre study carried out in the European region also documented an increased mean LOS of 106.7 days and 105.2 days for infants delivered at 23 weeks and 24 weeks gestation respectively as compared with 42.7 days for infants delivered at 31 weeks gestation.¹⁵ This is not surprising as the duration of hospital stay has been observed to be inversely proportional to the gestational age due to associated medical conditions observed especially in these preterms with decreased gestational age thus requiring a longer hospital stay. ^{7,15,16} The length of stay of preterm babies admitted in neonatal units vary dramatically as observed in the present study where babies delivered at 24 weeks gestational age had a mean LOS of 62.00±0.00 days which was much shorter than the mean LOS of 120.70 days reported in Saudi Arabia. 12 Similarly, the LOS of 31.00±1.41 days reported for preterms <1500 gm delivered at 36 weeks gestation in the present study was much longer than the mean LOS of 10.48±6.90 days reported in Bayelsa, Nigeria and the 9.588 days reported in Saudi Arabia. 11,12 These varying LOS could be attributable to the varying inclusion criteria in the various studies as observed in the present study where only preterms <1500 gm were recruited unlike the other studies cited above where all preterms irrespective of their weights were studied. 11,12 The varying discharge criteria in the various neonatal units as well as varying morbidity patterns could also contribute to the different LOS. The small sample size in the present study could also account for the disparity as most other studies which were multicentre studies had large sample sizes.

The length of stay in the present study was observed to increase significantly with a decrease in the birth weight with the longest stay observed in preterms <1000 gm (57.71±9.96 days) and shortest stay in preterms with birth weights 1400-1499 gm (31.92±12.02 days). This trend was similarly observed in Saudi Arabia, Iran and the United Kingdom.^{7,12,13} Similarly, Murki et al in India documented an increased median LOS of 60 (44-77) days among preterms <1000 gm while preterms 1250-1499 gm had a much lower median LOS of 22 (15-31) days.¹⁴ These varying length of stay could be attributed to differences in discharge criteria across different neonatal units and countries, availability of incubators as well as the knowledge and practice of kangaroo mother care especially in regions where there are insufficient incubators. Commencement of early KMC in the face of high demand of incubator care could lead to earlier discharges.

Length of stay in the hospital is not only primarily influenced by their gestational age and birth weights but also by the underlying medical conditions with/without complications. In the present study, preterms with early onset sepsis and anaemia were significantly associated with prolonged length of stay. Interestingly, preterms with other morbidities were observed to have longer length of stays than those without the morbidities although there was no statistical significance. This trend was also reported by Maier et al and Murki et al. ^{14,15}

There was no statistical difference in the association of infants demographic factors, maternal HIV status and maternal steroid antenatal use with LOS in the present study. Murki et al also documented no significant association between LOS and maternal antenatal steroid use but in contrast reported caesarean section and multiparity to have statistical significance with LOS. ¹⁴ On the contrary, Aly et al in the United states of America documented significant association of LOS with gestational age, birth weight, male sex, caesarean section delivery and multiple gestation. ¹⁸ The definition of LOS in the latter study of >3 days which differ from the present study could explain the disparity.

The limitation of this study is the small sample size thus further studies with larger sample size as well as multicentre study is therefore recommended.

CONCLUSION

The survival rate of preterm babies less than 1500 gm increase with increasing gestational age and birth weight while the length of stay increases with decreasing gestational age and birth weight. Preterm babies with early onset sepsis and severe anaemia are significantly associated with length of stay. Gestational age and birth weights are predictors of the survival of preterm babies. Prediction of survival rates and length of stay is thus crucial to facilitate conversations between clinicians and parents/caregivers thereby allaying anxiety.

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