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SHORT TERM SURVIVAL OF PREMATURE INFANTS ADMITTED TO THE NEW BORN UNIT AT MOI TEACHING AND REFERRAL HOSPITAL, KENYA.

Felicitas M Okwako, Paediatrician, Bungoma County, Ministry of Health. Winstone Nyandiko Associate Professor and Paediatrician, Department of Child Health and Paediatrics, Moi University. M Eren Oyungu Senior Lecturer and Paediatrician, Department of Medical Physiology, Moi University
Corresponding Author, Winstone Nyandiko Moi University School of Medicine, P.O Box 4606, Eldoret, Kenya

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FELICITAS M OKWAKO, WINSTONE NYANDIKO, M. EREN OYUNGU

ABSTRACT

Background: Short and long term survival rates of premature infants have been well documented in developed countries. However, there are few data in low resource settings describing the survival of preterm infants. Data on short term survival rates of preterm infants may inform clinicians in a resource limited setting when counseling families on expected outcomes of care.

Objective: To determine survival to hospital discharge of preterm infants in a public tertiary hospital in Kenya.

Design: Prospective hospital cohort study design was used.

Setting: Moi Teaching and Referral Hospital New Born Unit, Kenya.

Participants: Premature Infants and their mothers

Interventions: No study specific interventions were performed. We prospectively evaluated survival from admission until discharge from the hospital of 175 premature infants admitted to the newborn unit at Moi Teaching and Referral Hospital, a tertiary public hospital, between December 2012 and August 2013. We determined the overall survival rate and gestational age and birth weight category survival rates.

Main outcome measures and Analysis: Death or discharge was the main outcomes of interest. Cox Proportional Hazards model was used to determine factors associated with survival and Kaplan-Meier survival curves drawn.

Results: Of the 175 infants, 53.1% were female, mean birth weight was 1342g (\pm 355.5) and 37% were born before arrival. There were 15.4% neonates born less than 28 weeks, 30.9% aged 28-31 weeks and 53.7% above 32-37 weeks. The overall survival to hospital discharge was 60.6% (95% CI 0.53-0.68). The survival rate was 29.6% for infants born less than 28 weeks' gestation, 50% for those born at 28-31 weeks and 75.5% for those born at or above 32 weeks. Gestation age of \geq 32 weeks (HR 0.39, 95% CI 0.18-0.8), birth weight $>$ 1000g (HR 0.27, 95% CI 0.20-0.78) and maternal antenatal care attendance (HR 0.52, 95% CI 0.3-0.9) were associated with better survival. Caesarian section delivery was associated with increased risk of death (HR 4.26, 95% CI 1.88-9.66). Most of deaths (81%) occurred within the first seven days.

Conclusions: Sixty percent of premature infants admitted to MTRH new born unit survived to hospital discharge. The survival limit defined as the gestation at which a prematurely born infant has a 50% chance of survival was at the gestational age category of 28-32 weeks.

INTRODUCTION

Preterm birth is a major contributor to neonatal morbidity and mortality both globally and locally (1, 2). With advancement in perinatal care, short and long term survival rates of premature infants at various levels of neonatal intensive care units have improved and the trends well documented in high and middle income countries (3, 4, 5). That is not the case in most resource limited countries like Kenya. Over 90% of babies born in low-resource settings before 28 weeks' gestation die in the first few days of life (< 10% die in high-income nations), a 10:90 survival gap.

In developed countries, 50% of babies born at 24 weeks survive, whereas in low-resource nations, this survival rate is not achieved until 32 weeks of gestation (1). In a study done in Turkey in the year 2010 to evaluate mortality and short-term outcomes of very low birth weight infant's survival rates of 40% and 86.2% for infants weighing <1000g and 1000-1499g were reported (6).

A retrospective study done at Kenyatta National Hospital (KNH) in 1996 showed an overall neonatal survival rate of infants less than 2000 grams to be 62.2%. None of the 23 infants born less than 1000g survived the neonatal period in that study (7). This study aimed to provide information on the proportion of preterm infants admitted to Moi Teaching and Referral Hospital (MTRH) newborn unit that survive until discharge. As a tertiary public referral facility, data on short term survival of preterm infant would help the Moi teaching and referral hospital new born team to develop interventional strategies aimed at improving outcomes of this vulnerable group of patients.

MATERIALS AND METHODS

Moi Teaching and referral hospital is a multidisciplinary public tertiary facility with a level II new born unit that services an average of 200 babies per month comprising of those

born within the hospital and those born before arrival (referrals from lower level facilities and born at home).

The unit is staffed by 2 neonatologists, 4 paediatricians, resident doctors and nurses. The new born unit offers clinical care for term and preterm infants including use of antibiotics to treat infections, intravenous fluids, phototherapy, blood transfusion and enteral feeding but does not provide mechanical ventilation and exogenous surfactant for preterm babies with respiratory distress syndrome. Paediatric surgeons in the hospital take care of newborns with surgical conditions.

One hundred and seventy-five premature infants admitted to the unit between December 2012 and August 2013 were studied (26 were <1000g, 81 were 100-1499g and 68 were >1500g). Data was collected prospectively from clinical notes using a standardized questionnaire. The study was a non randomized cohort whose main inclusion criterion was gestation age less than 37 weeks calculated using the first day of the last menstrual period and complemented by clinical evaluation of the gestation age using the New Ballard score done by the two co-authors (8).

The data was abstracted from clinical charts at admission and it included maternal demographic data, infant clinical characteristics, and maternal pregnancy characteristics, neonatal causes of morbidity, interventions and outcome. Other information collected included birth weight measured by digital scale to the nearest one gram. The PI made chart reviews during follow up and noted any new diagnoses and interventions till discharge or death. The hospital length of stay was a secondary outcome. Ethical approval for the study was obtained from the hospital's Research and Ethics Committee.

Statistical analysis

Data was analyzed at 95% level of confidence. Descriptive statistics such as mean and median were used for continuous variables. Frequency listings and percentages were used to describe categorical variables. Survival analysis was done using Cox Proportional Hazards model used to determine factors associated with survival and Kaplan and Meier Survival curves drawn. Significant correlation was when the confidence interval did not contain 1 and p-value was less than 0.05.

A total of 175 preterm infants were studied from December 2012 to August 2013 with a male to female ratio of about 1:1. The mean gestation age was 31.94 weeks (± 3.06) and the mean birth weight was 1342grams (± 355.5). There were 15.4% born less than 28 weeks, 30.9% aged 28-31 weeks and 53.7% above 32 weeks. The overall short term survival to hospital discharge was 60.6% (95% CI 0.53-0.68). The survival rates were 11% and 59% for infants weighing <1000g and 1000-1499g, respectively. There was no difference in survival between males and females ($p=0.108$).

RESULTS:

The demographic characteristics of the infants are shown in Table 1.

Table 1:

Demographic Characteristics

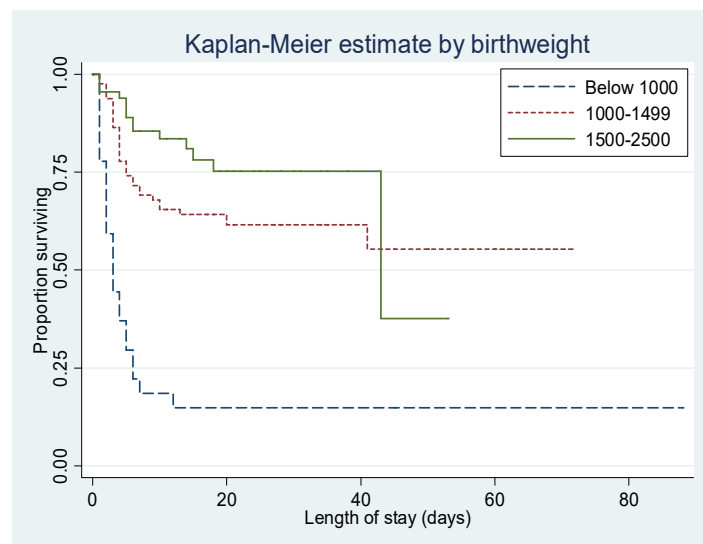
Characteristic	Frequency (n=175)	%
Gender: Male	82	46.9
Female	93	53.1
Gestation age: <28weeks	27	15.4
28-31weeks	54	30.9
32-36 weeks	94	53.7
Place of Delivery: MTRH	111	63.4
Born before arrival	64	36.6

The median maternal age was 24 years (range from 14 to 42 years). Majority of mothers, 117 (67.2%) were married and most of them were primigravidae, 85 (48.6%). Sixty-four percent of the mothers had attended antenatal clinic at least once. All mothers had their HIV status known with the most of them, 164 (93.7%) being HIV negative. Survival rate increased with increasing gestational age. (Table 2 & Fig 1). The highest survival rate was found among newborns with gestation age 32

– 36 weeks while the lowest was among those below 28 weeks. Premature infants born before arrival (at home or in other facilities) had an increased tendency to dying compared to those born in MTRH but the difference was not statistically significant ($p=0.09$ and 0.20 respectively).

Table 2*Correlates of Mortality (Infant and Maternal Characteristics)*

Variable	AHR	95%CI		P-value
Place of delivery				
Other facility vs MTRH	1.91	0.72	5.10	0.20
Home vs MTRH	2.48	0.87	7.11	0.09
GA in weeks				
28-31 vs <28	0.74	0.37	1.49	0.4
32-36 vs <28	0.39	0.18	0.82	0.013
Mode of delivery				
SBD vs SVD	1.62	0.76	3.45	0.209
EMCS vs SVD	4.26	1.88	9.66	0.001
Birth weight in g				
1000-1499 vs <1000	0.40	0.20	0.78	0.008
1500-2500 vs <1000	0.27	0.11	0.64	0.003
ANC attendance-Yes vs No)	0.52	0.30	0.90	0.020
HIV status-Pos vs Neg	1.57	0.55	4.54	0.403

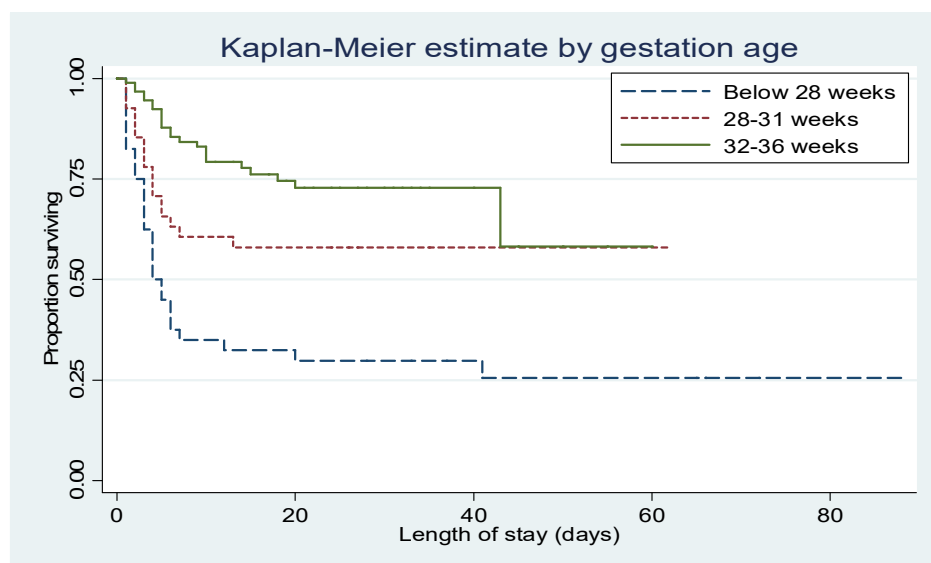
Figure 1:*Gestation age specific Kaplan-Meier survival**curve*

Neonates with LBW and VLBW survived well compared to those of ELBW. (Figure 2) Emergency CS was associated with 4-fold higher mortality, probably reflecting the perinatal complications like

fetal distress, ante partum hemorrhage and preeclampsia. However, attending ANC was associated with a 50 percent reduction in mortality

Figure 2:

Birth weight specific Kaplan-Meier Survival curve



DISCUSSION

This study determined survival to hospital discharge of preterm infants admitted to the newborn unit at Moi Teaching and Referral hospital, a public tertiary hospital in Kenya. Sixty percent of preterm infants survived to hospital discharge.

The overall survival rate is similar to outcome from studies done in other public hospitals resource limited setting more than ten years ago (8, 9). In Kenyatta National Hospital (KNH), another public tertiary facility in Kenya, a study done in 1996 by Were et al looked at 163 infants weighing less than 2000g and found a 62.2% survival to 28 days which is similar to our results (8). Kasirye-Bainda et al reported an overall neonatal mortality rate of 24.6% in KNH and found out that LBW and prematurity accounted for 95.6% of the mortality (10). In a

Tanzanian tertiary referral hospital, neonatal mortality rate of 19% was reported by Klingenberg et al and gestation less than 31 weeks accounted for 67% of the mortality (11).

Survival rate was lower for infants weighing less than 1500g. This is similar to findings by Kasirye-Bainda et al who reported survival of 48.7% among babies with birth weight less than 1500g while Were et al in the same hospital reported no survival of newborns less than 1000g and two thirds survival for bigger ones (8, 10). This trend where survival rate increasing with increasing birth weight is also true of gestation age as shown in our finding that highest survival rate was found among newborns with gestation age 32 – 36 weeks while the lowest was among those below 28 weeks. Were et al reported 69% survival among those with gestation 32 to 35 weeks and

only 9% for those less than 28 weeks' gestation (7). Increasing gestational age and birth weight is associated with organ maturity which enables preterm infants to adapt better to extra-uterine life.

The survival rate observed in this study is much lower than the one reported in countries with advanced neonatal care. In South Africa, Velaphi et al reported survival to hospital discharge of 32% among premature infants born at gestation below 28 weeks (4). Deniz in a study done in a tertiary hospital in Istanbul, Turkey reported survival rates of 40% and 86.2% for infants weighing <1000g and 1000-1499g, respectively (6).

However, the best survival rates are reported in the developed countries where survival for newborns with birth weights above 1000g is above 94% (5, 12). It has been shown that 25 – 45% of neonatal mortality occurs within the first 24 hours mainly as a result of birth asphyxia and prematurity. Of the infants who did not survive in our study, a tenth died within the first 24 hours while four fifths died during the first week of life. Other studies reported higher deaths within the first 24 hours, Simiyu (36%), Were et al (28%) and Ezechukwu et al (64.5%) in tertiary hospitals in Kenya and Nigeria respectively (8, 9, 13). Majority of the deaths in our study occurred during the first seven days, similar to findings by Kasirye et al where 86.8% of the deaths occurred within the first week of life (10).

Notably those studies were done in hospitals without continuous positive airway pressure (CPAP) facilities and in an era where exogenous surfactant and antenatal steroids were not widely used. These factors may explain the current finding of a lower proportion that died in MTRH in the first 24 hours with availability of CPAP and use of antenatal steroids. The higher numbers of preterm infants dying during the first week of life could be due to acute complications of prematurity occurring in a setting with limited neonatal intensive facilities to support the preterm infants. Extremely low birth weight infants who survived to hospital discharge had long lengths of

stay. This is similar to findings by Simiyu et al in a study to quantify the morbidity and mortality of low birth infants in KNH (8). This could be attributed to morbidity associated with complications of extreme prematurity and time taken to gain recommended weight before discharge more so in a setting where there is no parenteral nutrition for these infants.

This study showed that the limit of viability in MTRH newborn unit was 28 to less than 32 weeks gestation category. Although the WHO has established the upper limit of viability at 37 completed weeks of gestation they have not set the lower limit. The lower limit is defined by fetal organ maturity and advances in high risk obstetrics care and neonatal intensive care. The USA currently defines this lower limit as about 25 weeks or weight above 500g (12, 14).

Compared the developed countries, our viability limit is still high, a finding that could be explained by limitation in high risk obstetric care and neonatal intensive care. The mortality rate of preterm infants admitted in MTRH new born unit is still high especially for the very preterm and extremely preterm infants.

This study determined survival to hospital discharge of premature infants admitted to a new born unit in a public tertiary hospital in Kenya with limited neonatal intensive care resources. Sixty percent of premature infants admitted to MTRH new born unit survived to hospital discharge, including 30% of infants who were less than 28 weeks' gestation at birth. Findings of this study may be used for advocacy to improve neonatal services at MTRH and other similar public health facilities in Kenya.

LIMITATIONS

Assumption that survival probabilities are the same for study participants recruited at different times of the study. This was mitigated by recruiting babies over a period of eight months.

In addition, data on maternal antenatal steroid use was not available and therefore not controlled for in the analyses.

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DISCLOSURE:

The authors have no conflict of interest to declare.

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