IJN
Iranian Journal of Neonatology
http://ijn.mums.ac.ir

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Original Article

Mortality within the First 24 Hours of Admission among Neonates aged Less than 24 Hours in a Special Care Baby Unit (SBCU) in Nigeria: The Role of Significant Hypothermia and Hypoglycemia

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ABSTRACT

***Background*:** Neonatal deaths mostly occur within the first week or the first 24 hours of life due to a variety of conditions.

This study aimed to examine the role of significant hypothermia and hypoglycemia, in addition to a few other factors leading to neonatal mortality within the first 24 hours of admission.

***Methods*:** This prospective study was conducted on neonates hospitalized within the first 24 hours of life in a Special Care Baby Unit (SCBU) in Nigeria. The axillary temperature and serum glucose were consecutively recorded at admission. Through bivariate and multivariate analyses, hypothermia (axillary temperature < 36 °C) and hypoglycemia (random blood glucose < 40 mg/dL) were found to be associated with the risk of mortality within the first 24 hours of admission in neonates.

***Results*:** Out of 277 neonates, 24.2% and 27.3% had significant hypothermia and hypoglycemia, respectively. The overall mortality rate was 21.6% (49/227) while 38.8% (19/49) of the deaths occurred within the first 24 hours of admission. The Case Fatality Rate (CFR) was 41.2% among the neonates with co-existing significant hypothermia and hypoglycemia and 0.9% among neonates with neither of the conditions. Mortality within the first 24 hours of admission was significantly associated with hypoglycemia, significant hypothermia, asphyxia, and apnea, according to bivariate and multivariate analyses.

***Conclusion*:** Mortality within the first 24 hours of admission among the neonates admitted within the first 24 hours of life accounts for almost 40% of all neonatal deaths. In the present study, significant hypothermia and hypoglycemia were considered as the major independent contributors.

***Key words*:** Early neonatal death, hypothermia, Neonatal hypoglycemia, Perinatal mortality, Resource-poor settings

Introduction

In developing countries, recent data indicate that neonatal mortality contributes most to childhood death and it is the main reason under-five mortality rate is still high in many places (1). A number of studies conducted in Nigeria have suggested that neonatal mortality accounts for 40-50% of all childhood deaths (2, 3).

In some hospital-based studies performed in Nigeria and India, between half and three-quarters of neonatal mortalities occur within the first week of life (4-6) while 30-50% of these deaths have been reported to occur within the first 24-48 hours of life inside and outside Nigeria (6-8). As a result, perinatal mortality requires further attention since it forms the bulk of neonatal deaths (4).

Reports from Nigeria and other developing countries are suggestive of the fact that most perinatal and neonatal deaths occur as a result of such intra-partum events as asphyxia, infections and prematurity (4-8). Common to these three major conditions are temperature instability, particularly hypothermia and hypoglycemia (9, 10).

There is an interwoven relationship between temperature instability and glucose metabolism which explains the emergence of these co-existing conditions in critically-ill neonates (11). In Ibadan, Nigeria, hypothermia was reported as the major contributor to neonatal mortality which increased by a drop in the body temperature, especially if it was lower than 35.5°C (5) Moreover, hypothermia was confirmed in 72.4% of hospitalized high-risk neonates ageing less than 24 hours in Sagamu, Nigeria (12).

The first 24 hours of life, as well as the first 24 hours of admission, are crucial to the survival of

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critically ill neonates. Therefore, this study aimed to examine the role of hypothermia and hypoglycemia, in addition to a few other factors, in neonatal mortality within the first 24 hours of admission among neonates who had been hospitalized within the first 24 hours of their life.

Method

This prospective study was conducted at the Special Care Baby Unit (SCBU) of the Olabisi Onabanjo University Teaching Hospital, Sagamu, Ogun State, Southwestern Nigeria from January 2010 to August 2011. This unit provides general and specialized neonatal care (with the exception of intensive care) for infants who are delivered in the hospital as well as those referred from other facilities inside or outside Sagamu.

Institutional and ethical approval were obtained and the study was conducted on in-born and out-born neonates who had been admitted within the first 24 hours of birth. Infants who were dead-on-arrival and out-born infants who were referred without official referral notes providing the relevant perinatal details were excluded from the study.

The SCBU is supervised by a full complement of medical and nursing staff including two consultants, senior and junior resident physicians, medical interns, midwives and pediatric nurses providing 24-hour medical and nursing services in the unit.

According to the unit protocols, all the enrolled infants were weighed by Bassinet Weighing Scale at the point of admission. Following that, the neonates were evaluated in terms of Estimated Gestational Age (EGA) and intrauterine growth pattern through the modified Ballard method and the Lubchenco method, respectively.

The intrauterine growth pattern is classified into the following categories: 1) Appropriate for Gestational Age (AGA), 2) Small for Gestational Age (SGA) and 3) Large for Gestational Age (LGA).

On the other hand, the axillary temperature was measured by a digital thermometer (Model YB-009) reading as low as 32°C with an accuracy degree of ± 0.1°C. If APGAR scores were available, they would be recorded for each infant and if not available, especially in case of referred neonates, the infants would be clinically assessed for the likely presence of birth asphyxia.

The serum glucose and electrolytes were routinely measured at the point of admission. Furthermore, full blood count was performed for each infant at the point of admission. The derangements of the aforementioned parameters as well as any specific clinical disorders were recorded according to the standard protocols.

The obtained data consisted of age, gender, weight and EGA of the infants as well as the pattern of intrauterine growth, clinical diagnoses, commencement of enteral feeding and the results of initial laboratory investigations. Episodes of respiratory distress, apnea, seizure and severe anemia within the first 24 hours of admission were recorded as well.

In the present study, the axillary temperature of lower than 36.0C was defined as significant hypothermia (equivalent to moderate and severe hypothermia) while the serum glucose of lower than 40mg/dl (2.2 mmol/l) was defined as hypoglycemia. Moreover, severe anemia was defined as the Packed Cell Volume (PCV) of less than 30%. The outcome variable for the current study was the survival or death within the first 24 hours of admission into the unit.

The collected data were analyzed using SPSS software version 18.0 and bivariate and multivariate analysis. Proportions were compared by the Odd Ratio (OR) with 95% Confidence Interval (CI) and Chi-Squared test.

Additionally, student's T-test was used for comparing the mean values and standard deviations. Variables of a statistically significant association with mortality within the first 24 hours of admission were further analyzed through bivariate analysis by a binary logistic regression in order to detect their independent contributions to the outcome variable. P-value of less than 0.05 was considered statistically significant.

Results

A total number of 227 neonates were admitted within the first 24 hours of birth during the present study. Out of the 227 studied infants, 124 (54.6%) were ageing < 3hours, 49 (21.6%) were ageing 3–6 hours and 54 (23.8%) were older than 6 hours.

Furthermore, 119 (52.4%) were in-born while the remaining 108 (47.6%) were referred. The out-born infants accounted for the ones who had been delivered in other orthodox health facilities (N=88, 81.5%) and those delivered in residential homes or traditional birth homes (N=20, 18.5%). The types of delivery included spontaneous vertex (N=141, 62.1%), Caesarean section (N=78, 34.4%) and instrumental method (N=8, 3.5%). In addition, there were 51 (22.5%) multiple births and 176 (77.5%) singletons among the studied neonates.

The subjects consisted of 124 male and 103 female infants. The EGA ranged between 26 and

41 weeks with a mean of 35.4±6.0 weeks. Moreover, the infants' birth weight ranged from 0.6kg to 5.2kg with a mean of 2.5 ± 1.1kg. Among these neonates, 207 (91.2%) were AGA, 15 (6.6%) were SGA and 5 (2.2%) were LGA.

The clinical diagnoses were indicative of perinatal asphyxia (N=100, 44.1%), prematurity (N=87, 38.3%), presumed sepsis (N=14, 6.1%), perinatal exposure to HIV (N=7, 3.1%), acyanotic congenital heart defect (N=5, 2.2%), Meconium aspiration syndrome (N=4, 1.8%), Macrosomia (N=4, 1.8%), infants born from diabetic mothers (N=3, 1.3%) and congenital malformation (N=3, 1.3%).

Pattern of point-of-admission body temperature and blood glucose

In the present study, the body temperature on admission ranged from 32.5^{0}C to 37.9^{0}C with a mean of 35.9 ± 0.9^{0}C. Moreover, 55 neonates (24.2%) had significant hypothermia while 152 (67.0%), 16 (7.0%) and 4 (1.8%) had a normal body temperature, mild hypothermia and hyperthermia, respectively. In total, 172 neonates (75.8%) did not show any signs of significant hypothermia.

Random blood glucose on admission ranged from 13 to 350mg/dl with a mean of 82.7 ± 56.6mmol/L. In total, 165 neonates (72.7%) were normoglycemic and 62 (27.3%) were hypoglycemic.

As illustrated in Table 1, the overall prevalence of significant hypothermia and hypoglycemia extended from the first 3 hours of birth to a peak at 3-6 hours of birth and thereafter, declined in both cases. According to the obtained results, 38 infants (16.7%) had only hypothermia, 45 (19.8%) had only hypoglycemia, 17 (7.5%) had both hypothermia and hypoglycemia while 127 (56.0%) had neither hypothermia nor hypoglycemia.

Clinical characteristics and relative prevalence of hypothermia and hypoglycemia

As illustrated in Table 2, absence of significant hypothermia and hypoglycemia was significantly

Table 1. Age-related prevalence of hypothermia and hypoglycaemia

Age (hours)	*Hypothermia*		*Hypoglycaemia*	
	Frequency	Percentages (%)	Frequency	Percentages (%)
< 3	21/124	16.9	27/124	21.8
3 – 6	19/49	38.8	23/49	46.9
> 6	15/54	27.8	12/54	22.2

Table2. Relationship between the prevalence of hypothermia and hypoglycaemia and clinical characteristics of newborn infants

Characteristics	*Co-existing significant hypothermia and hypoglycaemia*	*Absence of significant hypothermia and hypoglycaemia*
Age < 3 hours (n = 124)	2 (1.6)	78 (62.9)
Age 3-24hrs (n = 103)	15 (14.6) {OR = 0.1; CI 0.01-0.5}	49 (47.5) {OR =1.9; CI 1.1-3.3
Inborn (n= 119)	6 (5.0)	81 (68.1)
Out-born (n = 108)	11 (10.2) {OR = 0.5; CI 0.2-1.4}	46 (42.6) {OR = 2.8; CI 1.6-5.1}
Orthodox Out-born delivery (n =20)	5 (25.0)	3 (15.0)
Home delivery (n = 88)	27 (30.7) {OR = 0.7; CI 0.2-2.5}	30 (34.1) {OR = 0.3; CI 0.07-1.4}
Spontaneous vertex delivery (n = 141)	28 (19.9)	39 (27.7)
Caesarean/instrumental delivery (n = 88)	21 (23.9) {OR = 0.7; CI 0.4-1.5}	34 (38.6) {OR = 0.5; CI 0.3-1.1}
EGA < 37 wks (n = 99)	11 (11.1)	41 (41.4)
EGA ≥ 37 wks (n = 128)	6 (4.7) {OR = 2.5; CI 0.8-8.1}	86 (67.2) {OR = 0.4; CI 0.2-0.6}
EGA < 32 wks (n = 48)	9 (18.8)	12 (25.0)
EGA 32 – 36 wks (n = 51)	2 (3.9) {OR = 5.6; CI 1.1-40.4}	29 (56.9) {OR = 0.3; CI 0.1-0.6}
Weight < 2kg (n = 92)	9 (9.8)	39 (42.4)
Weight ≥ 2kg (n = 135)	8 (5.9) {OR = 2.3; CI 0.7-6.8}	88 (65.2) {OR = 0.4; CI 0.2-0.7}
Weight < 1.5kg (n = 61)	9 (14.7)	15 (24.6)
Weight 1.5- 1.9kg (n = 31)	0 (0.0) {p = 0.024}	24 (77.4) {OR = 0.1; CI 0.03-0.3}
Singleton (n = 176)	12 (6.8)	102 (57.9)
Multiple (n = 51)	5 (9.8) {OR = 0.7; CI 0.2-2.3}	25 (49.0) {OR = 1.4; CI 0.7-2.8}
Appropriate for GA (n = 212)	17 (8.0)	124 (58.5)
Small for GA (n = 15)	0 (0.0) {p = 0.254}	3 (20.0) {OR = 5.6; CI 1.4-25.9}
Feeding commenced (n = 55)	0 (0.0)	37 (67.3)
Feeding not commenced (n = 172)	17 (9.9) {p = 0.015}	90 (52.3) {OR = 1.9; CI 1.1-3.7}

EGA – Estimated Gestational Age; GA – Gestational Age

Table 3. Relationship between the risk of death occurring within the first 24 hours and clinical characteristics of newborn infants

Characteristics	*Death within 24 hrs (n = 19)*	*Survival beyond 24 hrs (n = 180)*	*Statistics*
Age < 3 hours	5 (26.3)	102 (56.7)	OR = 0.3; CI 0.08-0.9
Age 3-24hrs	14 (73.7)	78 (43.3)	
Male	8 (42.1)	101 (56.1)	OR = 0.6; CI 0.2 -1.6
Female	11 (57.9)	79 (43.9)	
Inborn	7 (36.8)	95 (52.8)	OR = 0.4; CI 0.1-1.2
Out-born	12 (63.2)	85 (47.2)	
EGA < 37 wks	11 (57.9)	76 (42.2)	OR = 1.8; CI 0.7 – 5.4
EGA ≥ 37 wks	8 (42.1)	104 (57.8)	
EGA < 32 wks	6 (54.5)	35 (46.1)	OR = 1.4; CI 0.3 – 5.9
EGA 32-36 wks	5 (45.5)	41 (53.9)	
Weight < 2kg	9 (47.4)	71 (39.4)	OR = 1.4; CI 0.5 – 3.9
Weight ≥ 2kg	10 (52.6)	109 (60.6)	
Weight < 1.5kg*	9 (100.0)	43 (60.6)	$\chi^2 = 5.4$; P = 0.019
Weight 1.5 – 1.9kg*	0 (0.0)	28 (39.4)	
Feeding commenced*	0 (0.0)	44 (24.4)	$\chi^2 = 5.9$; P = 0.015
Feeding not commenced*	19 (100.0)	136 (75.6)	
Singleton	14 (73.7)	143 (79.4)	OR = 0.7; CI 0.2 – 2.5
Multiple	5 (26.3)	37 (20.6)	
Appropriate for GA	16 (84.2)	170 (94.4)	OR = 3.2; CI 0.6-14.6
Small for GA	3 (15.8)	10 (5.6)	

KEY: Figures in parentheses are the percentages of the respective totals. EGA – Estimated Gestational Age
*Odd Ratio not computed because one of the cells in a 2 × 2 table is empty

Table 4. Relationship between the risk of death occurring within the first 24 hours and some clinical disorders.

Clinical disorders	*Death within 24 hrs (n = 19)*	*Survival beyond 24 hrs (n = 180)*	*Statistics*
Hypoglycaemia present	12 (63.2)	46 (25.6)	OR = 4.9; CI 1.7 – 15.1
Hypoglycaemia absent	7 (36.8)	134 (74.4)	
Hypothermia present	13 (68.4)	40 (22.2)	OR = 7.6; CI 2.5 – 24.2
Hypothermia absent	6 (31.6)	140 (77.8)	
Coexisting hypothermia and hypoglycaemia present	7 (36.8)	10 (5.6)	OR = 9.9; CI 2.9 – 35.4
Coexisting hypothermia and hypoglycaemia absent	12 (63.2)	170 (94.4)	
Asphyxia present	17 (89.5)	78 (43.3)	OR = 11.1; CI 2.4 – 71.9
Asphyxia absent	2 (10.5)	102 (56.7)	
Respiratory distress present	13 (68.4)	31 (17.2)	OR = 10.4; CI 3.4 – 23.7
Respiratory distress absent	6 (31.6)	149 (82.8)	
Severe anaemia present	5 (26.3)	43 (23.9)	OR = 1.4; CI 0.3 – 3.6
Severe anaemia absent	14 (73.7)	167 (76.1)	
Seizure present	5 (26.3)	10 (5.6)	OR = 6.1; CI 1.5 – 23.2
Seizure absent	14 (73.7)	170 (94.4)	
Apnea present	14 (73.7)	12 (6.6)	OR = 39.2; CI 10.7 – 53.1
Apnea absent	5 (26.3)	168 (93.3)	

KEY: Figures in parentheses are the percentages of the respective totals.

Clinical characteristics and relative prevalence of hypothermia and hypoglycemia

As illustrated in Table 2, absence of significant hypothermia and hypoglycemia was significantly associated with age <3 hours, in-born status, AGA, EGA >37 weeks, weight >1.5kg and the commencement of enteral feeding prior to admission. On the other hand, co-existing significant hypothermia and hypoglycemia were significantly associated with age 3-24 hours, EGA <32 weeks, weight < 1.5kg and no enteral feeding.

Neither delivery outside orthodox health facilities nor Caesarean and instrumental delivery were found to have a significant association with co-existing significant hypothermia and hypoglycemia or with the absence of these conditions.

Pattern of mortality

Overall, 49 neonates (21.6%) died, 150 (66.1%) were discharged home while 28 (12.3%) were prematurely discharged despite medical advice. However, mortality analysis was limited to

Table 5. Multivariate analysis of clinical characteristics associated with death occurring within the first 24 hours of admission

Independent Variables	*Odd Ratio*	*P-value*	*95% Confidence Interval*
Age 3 – 24 hours	2.2	0.332	0.4 – 5.7
Hypoglycaemia	6.7	0.03	1.3 – 12.4
Significant hypothermia	7.5	0.01	1.6 – 11.3
Coexisting hypoglycaemia and significant hypothermia	0.3	0.678	0.06 – 0.6
Asphyxia	10.1	0.01	4.5 – 11.8
Apnea within 24 hours	15.1	0.0001	10.8 – 28.1
Seizures within 24 hours	5.4	0.143	0.5 – 12.1
Respiratory distress	0.9	0.989	0.1 – 5.7

only 199 neonates with a definite outcome.

In the current study, 19 neonates (9.5%) died within 24 hours of admission while 180 (90.5%) survived the first 24 hours. The remaining deaths (30/49, 61.2%) occurred at various points after 24 hours of admission (21 deaths occurred 25-72 hours while 9 deaths occurred after 72 hours).

The neonates who died within the first 24 hours of admission were significantly lighter (1.8 ± 0.9kg) compared to those who survived beyond 24 hours (2.6 ± 1.1kg) (t = 3.1, p = 0.003). Similarly, the neonates who died within the first 24 hours of admission had a significantly lower body temperature (35.2 ± 0.4^0C vs. 36.1 ± 0.9^0C; t = 4.3, p = 0.0002) as well as a significantly lower random blood glucose (45.8 ± 32.3mg/dl vs. 86.1 ± 69.6mg/dl; t = 2.5, p = 0.014) compared to the neonates who survived more than 24 hours.

The CFR within 24 hours of admission in the neonates with specific disorders were as follows: 1) co-existing significant hypothermia and hypoglycemia (7/17, 41.2%); 2) apnea (10/26, 38.5%); 3) respiratory distress (14/44, 31.8%); 4) severe anemia (11/48, 22.9%); 5) seizures (2/15, 13.3%).

Furthermore, the CFR was lowest among the neonates with neither hypothermia nor hypoglycemia (1/105, 0.9%).

Bivariate analysis

In Tables 3 and 4, mortality within 24 hours of admission was significantly associated with the infants' age on admission (3-24 hours), weight < 1.5kg, non-commencement of feeding and the presence of hypoglycemia and hypothermia.

In addition, co-existing significant hypothermia and hypoglycemia, asphyxia, seizures, apnea and respiratory distress occurred more frequently among the neonates who died within 24 hours of admission with a statistical significance.

Multivariate analysis

In Table 5, multivariate analysis indicated hypothermia and hypoglycemia to be significant predictors of mortality occurring within the first 24 hours of admission. Neonates with apnea and asphyxia were 15 and 10 times more prone to mortality within the first 24 hours of admission, respectively. Similarly, neonates with significant hypothermia and hypoglycemia were 8 and 7 times more likely to die within the first 24 hours of admission, respectively.

Discussion

As previously documented, the present study indicated significant hypothermia and hypoglycemia to be the most prevalent occurrences among Nigerian newborns (12, 13). In addition, the prevalence of both significant hypothermia and hypoglycemia was observed to increase from 16.9% and 21.8% in the infants admitted within the first 3 hours of birth to 38.8% and 46.9% in the infants admitted 3-6 hours after birth, respectively. Significant hypothermia and hypoglycemia occurred less frequently in the neonates ageing more than 6 hours on admission (27.8% and 22.2%, respectively). This pattern could be explained in terms of the physiological homeostatic mechanisms which are responsible for stabilizing the glucose metabolism as well as Thermoregulation in the immediate post-delivery hours. Such procedures are normally followed by the loss of the compensatory mechanisms in the absence of appropriate interventions (11).

As previously documented in similar studies, neonates with co-existing significant hypothermia and hypoglycemia were commonly older than 3 hours of age, had an EGA of less than 32 weeks and weighed less than 1.5kg (12,13). Such observations imply that these groups of infants need to be closely monitored for significant hypothermia and hypoglycemia so as to minimize the mortality and morbidity arising from clinical disorders (9, 10). Consequently, it could be claimed that neonates ageing less than 3 hours, in-born neonates, neonates with an EGA more than 37 weeks and the body weight of over 2kg as well as the ones who are commenced on enteral feeding prior to admission are unlikely to experience significant hypothermia and hypoglycemia. While infants in the latter group cannot be ignored in case they require admission, attention should be focused more on the former group of neonates in situations with busy nurseries and insufficient personnel. This is a typical picture of an average SCBU in the developing world.

For another thing, the mortality pattern indicated that one out of every five neonates admitted within the first 24 hours of birth eventually died at some point during hospitalization before reaching 28 days of age. Mortalities occurring within the first 24 hours of admission accounted for 38.8% of all the deaths recorded in this population of neonates.

The figure was higher than 26% as reported by a community-based study in Burkina Faso (14) while it was lower than 50% as observed in a multi-centre study in parts of the Low and Middle Income Countries (LMICs) (15) and 55% as reported by a previous Nigerian study (8)

The observed differences might be due to the selection pattern of the subjects. While the present study focused on infants admitted within the first 24 hours of birth, virtually all the previous studies had considered the selected neonates regardless of their age. Nevertheless, the prevention of death within the first 24 hours of admission, in neonates admitted within the first 24 hours of birth, will probably prevent two-fifth of the neonatal deaths as observed in the current study.

In addition, one out of every ten infants admitted within the first 24 hours of life died within the first 24 hours of admission. This might be a reflection of the critical state of the illness and conditions necessitating hospitalization within the first 24 hours of birth, especially since approximately half of the studied neonates had been referred.

The referred neonates had earlier been shown to account for 60-80% of mortalities in the same centre (4). This is usually due to their poorly managed transfer from the place of birth or referral which could pose the risk of severe morbidities such as hypoxia, hypothermia and hypoglycemia on them (16)

The primary reasons for hospitalization in the studied population were perinatal asphyxia, prematurity and infections. These conditions have been frequently associated with hypoxic features and poor tissue perfusion which, ultimately, leads to deranged tissue metabolism characterized by significant hypothermia and hypoglycemia as previously observed (12, 13).

Therefore, newborn infants who died within the first 24 hours of admission in the present study were significantly more immature and had a considerably lower mean body temperature and serum glucose. Thus, it is not surprising that in the present study, significant hypothermia, hypoglycemia, asphyxia, seizures, apnea and respiratory distress were found to have strong associations with fatality occurring within the first 24 hours of admission.

Similarly, ageing more than 3 hours on admission, weighing less than 1.5kg and lack of feeding prior to admission were significantly associated with mortalities occurring within the first 24 hours of admission. The relationship between the latter group of the neonates and the risk of death within the first 24 hours of admission might be correlated with a higher mortality rate of those groups of neonates with low birth weight, asphyxia, seizures and apnea with co-existing or complicating hypothermia and hypoglycemia (17-20).

On the other hand, multivariate analysis indicated that significant hypothermia, hypoglycemia, asphyxia and apnea made independent contributions to the occurrence of deaths within the first 24 hours of admission.

As a result, it is safe to say that scrupulous prevention and management of asphyxia, hypothermia, hypoglycemia and apnea could noticeably decrease the proportion of newborn mortalities occurring within the first 24 hours of admission among the neonates admitted within the first 24 hours of birth.

Consequently, it is essential that the quality of services available at the primary and secondary levels of health care in the developing world be scaled up in order to provide accurate and reliable measurements of body temperature and serum glucose in addition to developing skills as to detect apnea, respiratory distress and seizure.

When presented at the primary and lower levels of care, high-risk neonates with any of these conditions need to be promptly referred to better-equipped facilities for more efficient management. However, the role of basic and effective pre-referral care such as effective provision of warmth and maintenance of serum glucose should not be neglected.

In this regard, early commencement of breastfeeding and skin-to-skin care has been recommended as an effective measure (12). In addition to training and re-training, task shifting might also be beneficial in achieving such level of healthcare where adequate health personnel are not available. The lower skilled cadres could be efficiently trained so as to assist mothers with initiating early breastfeeding and safe provision of warmth.

At the tertiary levels of care, intensive care should be made available, especially for thermoregulatory, ventilatory and circulatory

supports. Despite the fact that intractable hypoglycemia requiring glucagon or steroidal therapy is rather uncommon, scrupulous management of more frequently encountered mild-to-moderate hypoglycemia with increasing concentrations of glucose using efficient modes of delivery needs to be routinely practiced at the tertiary levels of care. Depending on the availability, caffeine or aminophylline could be used in the management of newborn apnea which is a condition to be further explored.

Conclusion

Mortalities within the first 24 hours of admission in neonates hospitalized within the first 24 hours of life accounted for 38.8% of all neonatal deaths in the present study. Deaths within the first 24 hours of admission could be reduced with meticulous prevention and management of significant hypothermia, hypoglycemia, perinatal asphyxia and apnea. Such efforts will enhance the reduction of neonatal mortality in particular, and the reduction of under-five childhood deaths in general.

Acknowledgement

Hereby, we highly appreciate the support and cooperation of the medical interns engaged in the SCBU, OOUTH, Sagamu, Nigeria in the present study. We would also like to thank Biodun Allison of the Department of Health Information Management, OOUTH, Sagamu, Nigeria. Information Management, OOUTH.

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