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Research Article

Prevalence, Risk Factors and Outcome of Immediate Post Natal Hypoglycemia in Newborns in Two Hospitals of Limbe Health District

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Abstract

Background: Neonatal hypoglycemia is a major metabolic problem. Neonates who are born preterm, small or large for gestational age and neonates born to diabetic mothers are at greater risk and it may result to severe neurodevelopmental complications and death. The prevalence in the South-West Region is unknown. The aim of this study was to determine the prevalence, risk factors and outcome associated with immediate postnatal hypoglycemia in the Limbe health District.

Methods: A hospital-based cross-sectional study was carried out over a period of 4 months (4th December 2023-4th April 2024). Glycemic checks were done for the neonates born within the two hospitals in the Limbe Health District, 30 minutes after birth. Consent was gotten from the mothers of the neonates and questionnaires filled consisting of demographic data, antenatal and perinatal history. Data was entered into excel sheets and analysed using the SPSS version 26.0.

Results: Amongst the 152 babies who were recruited, the prevalence of Immediate post-natal hypoglycemia was 24 (15.8%). Males and preterm were more prone to hypoglycemia. Positive risk factors to neonatal hypoglycemia were the preterm (AOR= 100.654 95% CI=11.168-907.135; p=0.000). The most common outcome of neonates with hypoglycemia in our study was decrease in physical activity occurring in about 50% of the neonates with hypoglycemia and a mortality rate of 1.3% was registered.

Conclusion: The incidence of immediate post-natal hypoglycemia is high in our setting. The neonates at risk were the preterm babies. Male babies were more prone to hypoglycemia. The most common outcome was decrease in physical activity. Identifying risk groups, early diagnosis and prompt management will prevent and reduce complications of post-natal hypoglycemia in neonates.

Keywords: Prevalence; Risk Factors; Outcome; Neonatal Hypoglycemia; Limbe

Introduction

Hypoglycemia meaning a decreased sugar level in blood was coined by Harris in the late 19th century [1]. Over the last century there has been a large body of literature looking into the effects of low blood glucose, specifically in neonates, however there is little consensus regarding its definition or acceptable range of glucose in various types of neonates [2]. Hypoglycemia in neonates

is defined as a plasma glucose level of less than 30 mg/dl(1.65 mmol/l) in the first 24 hours of life and less than 45 mg/dl(2.5 mmol/l) thereafter [3]. Hypoglycemia is the most common metabolic disorder occurring in neonates which is an emergency that requires urgent correction. Neonatal hypoglycemia is a preventable cause of neurological sequelae [4]. It is crucial in developing nations where neonatal mortality accounts for between 50% and 60% of all infant fatalities [2]. Glucose is an essential fuel for brain metabolism and neonates have a high brain-to-body weight ratio and as such have a 2-to-3-fold higher glucose demand and utilization rate of glucose than adults. The overall worldwide incidence of hypoglycemia in neonates is 1.3-5 per 1000 live births [3]. The prevalence in Africa is about 15.2% and the incidence could increase up to 30-50% in neonates who have risk factors. The prevalence in Cameroon is about 8.8% [5].

The risk is particularly high in preterm infants, low birth weight or small for gestational age infants, large for gestational age and infants born to diabetic mothers [6]. Ironically, neonates commonly develop transient hypoglycemia in the first few hours of life as a normal physiological process known as transient hypoglycemia. One to two hours after birth, blood glucose levels fall to a physiological nadir and after 3 hours should normalize. However, in at risk neonates, gluconeogenesis or cytogenetic mechanisms that normalize blood sugar are either absent or reduced thereby predisposing them to hypoglycemia [7]. Hypoglycemia may manifest symptomatically by jitteriness, apathy, lethargy, high pitched cry, sweating, pallor, eye rolling and even seizures [7]. However, hypoglycemia may also be asymptomatic in some cases and can be detected only on blood sugar monitoring [8].

A study done in the United States revealed that babies born to pre eclamptic mothers had apnea, cyanosis, convulsions and coma due to hypoglycemia. Very serious consequences like cardiac arrest, coma and even death have also been documented in literature. Therefore, optimal management of these newborns with hypoglycemia is urgently required to prevent adverse outcomes. The most frequently used treatment for Neonatal Hypoglycemia (NH) includes breast milk or formula feeding, oral glucose or 5 mL/kg of 10% glucose intravenously and continuous oral feeds in addition to the treatment of the underlying disease [9]. Although universal screening of asymptomatic and low-risk neonates for hypoglycemia may be unnecessary and harmful, there is evidence that asymptomatic hypoglycemia could result in neurodevelopmental abnormalities in up to 20% of affected neonates [10]. Neonatal hypoglycemia is the most common metabolic disorder during the neonatal period and is a recognized trigger of infantile spasms [11].

There is paucity of data on the incidence of immediate post-natal hypoglycemia in Cameroon and Sub-Saharan Africa. Our study then seeks to determine the prevalence, risk factors and possible outcome of immediate post-natal hypoglycemia in newborns in two hospitals in the Limbe Health District of the Southwest Region of Cameroon.

Material and Methods

During a period of four months from 4th of December 2023 to 4th of April 2024, we carried out glycemic checks for the neonates born within this period using a hospital cross sectional study at the neonatology units and maternities of the Regional Hospital Limbe (RHL) and the Bota District Hospital (BDH) of the Fako Division of the Southwest Region of Cameroon. The RHL is the principal referral level hospital in the region having at least one specialist in pediatrics, obstetrics and gynecology, internal medicine and surgery. Apart from these specialists, there is a huge turnover of patients in these health facilities.

The study population included the neonates who were born at both hospitals during the study period. The estimated sample size was 123 neonates using the Cochran's formula. Administrative authorization was obtained from the Regional Delegation of Public Health for the Southwest Region and the Directors of the health facilities involved in the study. The ward charge of the neonatology units and maternities of these health facilities were then informed about the study and permission was granted to access the wards, get consent from the mothers of the babies, administer questionnaires to the mothers of the babies for completion of data. Once baby is born, 30minutes later, under aseptic techniques, we began by cleaning the newborn's heel with alcohol swab and dried cotton. Then pricking the heel with a single-use safety lancet and then the blood placed on the strip fitted in the One Touch Verio Reflect glucometer and compression dressing done on the site of collection. The values of hypoglycemia used for this study was <47 mg/dl for all the newborns, both term and preterm. All neonates who were hypoglycemic depending on the severity were managed using 2 ml/kg of IV Dextrose and the preterm neonates requiring urgent management were referred to the neonatology unit of the LRH. About 2 hours after baby was born, the questionnaires were filled by the nursing mothers with the help of the principal investigator, midwives and medical students to identify risk factors for neonatal

hypoglycemia in the neonates using pretested structured questionnaires.

Data collected were coded and entered in excel sheets to avoid an accumulation of work at the end. The entered data was always cross-checked to minimize errors. Data were analyzed using Statistical Package for Social Sciences version 26.0 after data cleaning. Frequency tables were exported to Microsoft excel 2016 to draw charts. Categorical variables were presented as frequencies and percentages. Continuous variables were presented as means and standard deviations. The Chi-square test was used to establish if there was a relationship between independent and dependent variables. All independent variables with p-values less than 0.05 in the chi-squared analysis were included in the final logistic regression model (multivariate analysis). Statistical significance was set at a p-value <0.05 at a 95% confidence interval.

Results

A total number of 161 neonates were recruited during our study period, 96 from the LRH and 66 from the BDH among which 2 were stillbirths and 7 from mothers who did not give their consent. Out of these, 24 (15.8%) neonates had immediate post-natal hypoglycemia, as shown in Fig. 1. Among the 152 neonates retained in our study, 79 (52.0%) were males and 73 (48.0%) were female. With 17 (11.2%) born below 2.5 kg and 51 (33.6%) who were macrosomic. There were more term neonates 130 (85.5%) than preterm neonates 12 (7.9%). The most represented maternal age range was 21-29years 81 (53.3%), while most had attained at least university education 94 (61.8%) and majority where self-employed 68 (44.7%) as shown by Table 1,2. With respect to the mothers antenatal and peripartum history, 44 (28.9%) attended less than 4 ANCs and 108 (71.1%) attended 4 or more times, with 4 (2.6%) having gestational diabetes mellitus and 5 (3.3%) having pre-eclampsia. Labour was prolonged in 45 (29.6%) of cases and normal in 95 (62.5%), with more babies born vaginally as compared to babies born via caesarean section. Classifying the newborns with hypoglycemia, 2 (8.3%) had mild hypoglycemia, while 22 (91.7%) had moderate hypoglycemia and none had severe hypoglycemia as shown in Table 3. Specifically in this group of hypoglycemic newborns, 15 (62.5%) were male, 14 (58.3%) were term and 8 (33.3%) were preterm as show in Table 4.

Following bivariate analysis, weight <2.5 kg (p=0.000), preterm neonates (p=0.000), primary level of education (p=0.044), were found to be significantly associated with immediate post-natal hypoglycemia (Table 5). After fitting a multiple logistic regression, being preterm was statistically associated with immediate post-natal hypoglycemia as seen on Table 6; with babies born preterm being 100 times more likely to have neonatal hypoglycemia as compared to babies who were term. Among the hypoglycemic neonates in this study, 12 (50%) had decrease in physical activity, 21 (87.5%) were managed with IV glucose and a fatality rate of 2 (8.3%) as illustrated in Table 7. Meanwhile, among the total number of neonates in our study, 2 died, giving a mortality rate of 1.3%. The mortality of both neonates was associated with hypoglycemia and other severe medical conditions, including birth asphyxia, neonatal sepsis and respiratory distress syndrome. Both infants were admitted at the Neonatology unit and treated with IV medications and Oxygen therapy for about 5-7 days. The complex interplay between these comorbidities and resultant hypoglycemia presented significant clinical challenges, ultimately contributing to their demise.

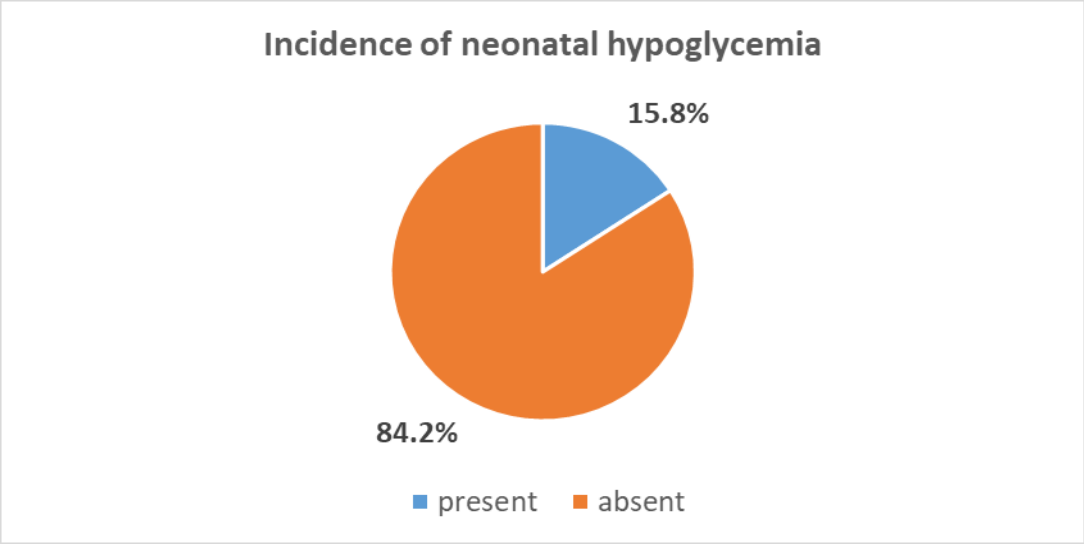

Figure 1: Incidence of neonatal hypoglycemia.

Variables	Number (n=152)	Percentage (%)
Sex		
Male	79	52.0
Female	73	48.0
Weight		
<2.5kg	17	11.2
2.5 - 4.0kg	84	55.3
>4.0kg	51	33.6
Gestational Age		
Term	130	85.5
SGA term	8	5.3
Preterm	12	7.9
SGA Preterm	2	1.3

Table 1: Sociodemographic profile of neonates.

Variables	Number (n=152)	Percentage (%)
Age group		
≤20	12	7.9
21-29	81	53.3
30-39	55	36.2
≥40	4	2.6
Marital status		
Single	62	40.8
Married	88	57.9
Divorced	1	0.7
Widow	1	0.7
Religion		
Christian	146	96.1
Muslim	6	3.9
Level of education		
Primary	8	5.3
Secondary	50	32.9
University	94	61.8
Occupation status		
Unemployed	42	27.6
Self employed	68	44.7
Employed	42	27.6

Table 2: Sociodemographic profile of the mothers.

Variables	Number(n=24)	Percentage (%)
Mild	2	8.3
Moderate	22	91.7
Severe	0	0.0
Total	24	100.0

Table 3: Classification of neonatal hypoglycemia.

Variables	Number (n=24)	Percentage (%)
Sex		
Male	15	62.5
Female	9	37.5
Weight		
<2.5kg	8	33.3
2.5-3.5kg	8	33.3
>3.5kg	8	33.3
Gestational Age		
Term	14	58.3
SGA term	1	4.2
Preterm	8	33.3
SGA Preterm	1	4.2

Table 4: Specific groups of neonates who were more prone to immediate post-natal hypoglycemia.

Variables	Number (n)=24	Percentages (%)	Odd ratio	P value
Sex				
Male	15	9.9	0.6(0.245-1.470)	0.264
Female	9	5.9	1	/
Weight				
<2.5kg	8	5.3	8.444(2.546-28.010)	**0.000**
2.5-3.5kg	8	5.3	1	/
>3.5kg	8	5.3	1.767(0.619-5.045)	0.287
Gestational Age				
Term	14	9.2	1	/
SGA term	1	0.7	1.1849(0.135-10.340)	0.879
Preterm	8	5.3	16.571(4.417-62.167)	**0.000**
SGA Preterm	3	0.7	8.286(0.491-139.947)	0.143
Level of education				
Primary	3	2.0	5.040(1.044-24.332)	**0.044**
Secondary	11	7.2	2.369(0.928-6.04)	0.071
University	10	6.6	1	/
Number of ANC's				
<4	10	6.6	1.975(0.802-4.864)	0.1391
≥4	14	9.2	1	/
History of pre-eclampsia/eclampsia				
Yes	2	1.3	3.788(0.598-23.987)	0.157
No	22	14.5	1	/
Duration of labour				
<18 hours	8	5.7	1.251(0.483-3.240)	0.645
≥18 hours	14	10.0	1	/
Mode of delivery				

Caesarean	10	6.6	1.692(0.691-4.143)	0.250
Vaginal	14	9.2	1	/

Table 5: Bivariate analysis of risk factors associated with hypoglycemia.

Variables	AOR (95%CI)	P value
Gestational Age		
SGA Term	2.493(0.206-30.118)	0.473
Preterm	100.654(11.168-907.135)	**0.000**
SGA Preterm	1.234(0.035-43.044)	0.908
Term	1	

Table 6: Multivariate analysis of risk factors associated with neonatal hypoglycemia.

Variables	Number (n=24)	Percentage (%)
Seizures		
Yes	0	0.0
No	24	100.0
Decrease in activity		
Yes	12	50.0
No	12	50.0
Management		
Breastfeeding	1	4.2
IV glucose 10%	21	87.5
Oral glucose	2	8.3
None	0	0.0
Is the baby alive		
Alive	22	91.7
Death	2	8.3

Table 7: Outcome of immediate post-natal hypoglycemia.

Discussion

Neonatal hypoglycemia is the most common metabolic condition affecting neonates and leading to severe complications like coma, neurodevelopmental sequelae and even death. Neonatal hypoglycemia is a preventable cause of neurological sequelae especially in the developing world where neonatal mortality accounts for a greater proportion of all infant fatalities. Regrettably, early diagnosis and treatment is scarce. In our study, the incidence was found to be 158 per 1,000 live births (15.8%). This result was similar to 15.3% in a study done in India [12]. This prevalence was however lower than 32.7% in Nigeria, 21.2% in Ethiopia, 39% in South Africa, 34.3% in China and 33.7% in Canada [4,10-15]. This variation can be explained by the difference in sociodemographic characteristics of the mothers in our study. Most women had at least secondary level of education as compared to the other studies where most women had no formal education hence had little decision-making ability concerning ANC follow up. Furthermore, this variation in prevalence could be because some of these studies only included neonates at risk for hypoglycemia and some studies had greater cutoff values for hypoglycemia, hence the variation. The above studies also had a greater sample size than ours. In contrast, this finding was higher than that obtained in Israel 12.1% in 2017, Australia 8.8% in 2013 and in India in 2023 where the cutoff value for hypoglycemia was <46 mg/dl [16-18]. These differences may be explained by differences in the type of health facilities, sample size variations, socio demographic characteristics of the mothers and the timing of measuring the glycemia could influence the results.

Male babies were more prone to having hypoglycemia, this was similar to studies done in Ghana, Nigeria who also had a male predominance [10,12]. However this was contrary to a study done in Bamenda, Cameroon where female babies were more prone to having hypoglycemia [5]. Male neonates are more prone to hypoglycemia due to several factors. Firstly, hormonal differences play a significant role; male neonates typically have lower levels of counter-regulatory hormones such as cortisol and catecholamines, which are crucial for maintaining blood glucose levels through gluconeogenesis and glycogenolysis [3].

Secondly, male neonates often have higher metabolic demands due to larger body size and faster growth rates, which can lead to a higher likelihood of hypoglycemia if their nutritional intake does not meet these increased energy needs [19]. Additionally, male infants are more frequently born preterm compared to females and preterm infants have immature liver enzyme systems that are less effective at storing and mobilizing glycogen, further contributing to the risk of hypoglycemia [20]. Furthermore, there are indications that male neonates might exhibit higher insulin sensitivity, which can cause more rapid glucose uptake and utilization, leading to lower blood glucose levels if glucose supply is insufficient. Genetic and developmental factors unique to male infants may also influence their susceptibility to hypoglycemia, although more research is needed to fully understand these mechanisms [20].

Following bivariate analysis, weight < 2.5 kg, preterm neonates and primary level of education for mothers were significantly associated with immediate post-natal hypoglycemia. Newborns with a birth weight under 2.5 kg, often classified as Low Birth Weight (LBW), typically have inadequate glycogen stores in the liver. Glycogen is a crucial energy reserve that helps maintain blood glucose levels during periods of fasting or stress. In LBW infants, these stores are often depleted quickly, leading to hypoglycemia [19]. LBW infants frequently have immature liver enzyme systems, which impairs gluconeogenesis (the production of glucose from non-carbohydrate sources) and glycogenolysis (the breakdown of glycogen into glucose).

However, after multivariate analysis, being preterm was statistically associated with immediate post-natal hypoglycemia. Preterm neonates were more prone to having hypoglycemia. This was similar to a study done in Uganda [6]. This can be explained by the immaturity of the pancreas of preterm babies, inadequate glucose supply, low or insufficient fat stores which puts them at risk of having hypoglycemia. Low glucagon or fat stores; this occurs in preterm and small for gestational age infants, due to the immaturity of the pancreas, there is reduced production and secretion of glucagon for gluconeogenesis leads to a relatively lower production of glucose. SGAs and preterm infants are born with decreased adipose tissue and experience increased metabolic demands due to their relatively large brains to body size [21,22].

The most frequent complication of neonatal hypoglycemia was decrease in physical activity 50% which was similar to studies done in Nigeria and Denmark as well as in Uganda [6,10,23]. Decrease in physical activity is quite common in neonates with hypoglycemia which is a neuroglycopenic symptom as a result of reduced glucose in blood, hence the prompt management will help prevent complications and future neurologic sequelae. About 1.3% of the neonates in the study died. The mortality of both neonates was associated with severe conditions, including birth asphyxia, neonatal sepsis and respiratory distress syndrome. Both infants were admitted at the Neonatology unit and treated with IV medications and Oxygen therapy for about 5-7 days. The complex interplay between these comorbidities and resultant hypoglycemia presented significant clinical challenges, ultimately contributing to their demise.

Strengths

To the best of our knowledge, this was the first study carried out in the Limbe Health District on Immediate postnatal hypoglycemia in the Southwest Region of Cameroon and it will serve as an eye opener to the strict monitoring of preterm babies.

Limitation

This study was carried out only in two health facilities in the Limbe Health District and so does not reflect the entire community.

Conclusion

The incidence of immediate post-natal hypoglycemia was 158 per 1,000 live births (15.8%) which is high. Males and preterms were more prone to hypoglycemia. Positive risk factor to neonatal hypoglycemia was being born preterm (p value= 0.000). The most common outcome of neonates with hypoglycemia in our study was decrease in physical activity occurring in about 50% of the neonates with hypoglycemia and a mortality rate of 1.3% in this cohort of newborns.

Conflict of Interests

The authors have no conflict of interest to declare.

Author Contributions

NM conceived the study and drafted the initial manuscript, CC and EW participated in data extraction and analysis, VS reviewed

and corrected.

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