

Prevalence and Determinants of Hypoglycemia in Neonates Admitted in the Neonatology Unit of the Bamenda Regional Hospital

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RESEARCH

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ABSTRACT

Hypoglycaemia is a common metabolic problem in the new-born that is often asymptomatic, but capable of causing both acute and chronic adverse consequences. This study aimed to determine the prevalence and identify risk factors associated with neonatal hypoglycemia at the neonatology unit of the Bamenda regional hospital, Cameroon

Patients and Methods

This was a prospective cross-sectional study carried out from 9th February 2022 to 31st May 2022 at the Neonatology unit of the Bamenda Regional Hospital, in the Northwest Region (NWR) of Cameroon. It involved 204 new-borns between 0 – 28 days of life, admitted at the neonatology unit of the Bamenda regional hospital for any reason. Data was collected through interviews with parents, examining the new-borns, reviewing follow-up records, and analyzing glucose levels in capillary blood from the fingertips. A structured questionnaire was used to gather information on sociodemographic, maternal, and neonatal factors. Blood glucose levels were measured using a test strip and a glucometer. Hypoglycemia was defined as having a random blood glucose level of less than 45mg/dl. The data collected was entered and

analyzed using SPSS version 20. Results: Newborns of 0-3 days (59.8 Per cent) were the most represented with a female predominance (sex ratio=0.7). The most common diagnosis on entry was neonatal infections (47.8 Per cent). The mean neonatal blood glucose level was 105.6mg/dl. The prevalence of hypoglycaemia was 8.8 Per cent. Following multivariate analysis, the risk factor associated with neonatal hypoglycaemia was low birth weight (OR=1.681; CI95 (0.994-2.842); p=0.043)

Conclusion

The prevalence of neonatal hypoglycaemia was 8.8 Per cent. The significant factor associated with hypoglycaemia was low birth weight. Regardless of why a new-born is admitted to the neonatology unit, it's important to carefully check for hypoglycaemia. Using capillary blood glucose is a good option because it allows for quick management.

Key Words

Hypoglycaemia, Neonate, Prevalence

Introduction

Hypoglycemia is the most common metabolic issue in new-borns and is defined as a plasma glucose level below 30 mg/dL (1.65 mmol/L) in the first day of life and below 45 mg/dL (2.5 mmol/L) after that¹. New-born hypoglycemia is an emergency that requires quick correction. At birth, the new-born's series of events that help regulate blood sugar levels². If this adaptation is unsuccessful, it will lead to hypoglycemia³. The overall incidence of neonatal hypoglycemia has been estimated to be 1 to 5 per 1,000 live births⁴, but can reach as high as 30 Per cent - 60 Per cent in at risk populations⁵. Several factors can increase the risk of neonatal hypoglycemia. These include prematurity, small for gestational age, post maturity, multiple gestation, perinatal asphyxia, having hypothermia or sepsis, maternal toxemia, an infant of a diabetic mother, delayed initiation of feeding, large for gestational age

babies, neonates with polycythaemia, and those who underwent exchange transfusion^{6,7}. These factors can cause hypoglycemia by disrupting the processes of glycogenolysis or gluconeogenesis, decreasing the production of alternate fuels, increasing the demand for glucose, and causing a failure to receive or absorb nutrients⁸.

Neonatal hypoglycemia can cause neurologic damage, seizures, physical and learning difficulties, epilepsy, mental retardation, behavioural and personality disorders and even death. The longer hypoglycemia lasts and the greater the glucose nadir, the more devastating the consequences. Comorbidities are also important in development of neurological damage⁹. Therefore, timely identification of risk factors and interventions prevent neonates from unwanted complications of hypoglycaemia.

Neonatal mortality rates remain high in Cameroon¹⁰. It becomes an important public health concern to reduce preventable neonatal deaths. Early detection of neonates at risk for hypoglycaemia and prompt management can reduce neonatal deaths. There still exists paucity of data on the prevalence and risk factors of neonatal hypoglycaemia in developing countries^{11,12}. In this study, we present the prevalence and identify the risk factors of neonatal hypoglycaemia in new-borns within 0-28 days of life at the referral teaching hospital in the North West Region of Cameroon.

Methodology

This was a hospital-based cross-sectional study, conducted from 9th February 2022 to 31st May 2022 at the Neonatology unit of the Bamenda Regional Hospital (BRH), the largest teaching hospital in the Northwest Region (NWR) of Cameroon. Bamenda is the capital city of the North West Region and has an estimated population of 514,000 inhabitants. It is the main state-owned tertiary hospital in the NWR with a specialized Neonatal intensive care Unit. It receives term and preterm neonates born within the hospital, from private and public hospitals within and out of the town, and even those babies not born in health facilities. Approximately 300 neonates are admitted into the unit each month

Inclusion criteria

All term and preterm neonates admitted to the Neonatology unit of the RHB during the study period, less than 28 days old whose mothers gave consent were included.

Procedure

Sample size calculation

The sample size was calculated using a formula for

estimation of single population proportion taking the magnitude of neonatal hypoglycaemia in Neonatal unit of the BRH to be $p=36.7$ Per cent margin of error 5 Per cent and using 95 Per cent confidence level. A sample size of 89 was calculated. This was based on the previous prevalence of neonatal hypoglycaemia of 36.7 Per cent conducted in a study in 2017 at the Limbe Regional Hospital, South West Region, Cameroon (unpublished data).

Data collection

We collected socio-demographic and clinical data using a pre-tested questionnaire and a chart review. The questionnaire was established to collect socio-demographic data, prenatal, perinatal and postnatal history alongside the state of the new-born at the neonatology unit. The data was collected by general practitioners and health officers working in the neonatal unit. Glycemia measurements were done using a standard glucometer (SD CodeFree™). The test strip was inserted into the meter, after cleaning the pre-warmed finger under usual aseptic conditions and drying, a skin puncture was done on the tip of the fingertip, on the lateral side by a lancet. The first drop of blood was discarded then the second drop of blood was applied to the test strip and blood glucose was noted. In case of hypoglycaemia, it was corrected according to the standard protocol in the unit. The neonate was monitored; blood glucose was checked every 3 hours by the capillary method until the hypoglycaemia was resolved.

Data processing and analysis

Collected data from questionnaire were entered into a computer through the software statistical for social sciences (SPSS) version 21 and later analysed. Results were presented as mean with standard deviation, minima and extrema for quantitative variables. For the qualitative variables the frequency and proportions were calculated. Pie and bar charts were used to demonstrate the distribution of discrete quantitative data while histograms were used for continuous data.

A bivariate analysis was done to look for the association between the factors leading to neonatal hypoglycaemia, and the independent variables. The degree of association was determined by the odd's ratio with a confidence interval at 95 Per cent. A multivariate analysis with a binary logistic regression model was used to eliminate confounding variables amongst all the statistical significant variables.

We obtained ethical approval from the Bamenda Regional Hospital ethics committee before the study. The process was strictly anonymous.

Results

A total of 204 neonates were enrolled during the study period. Majority of the neonates were aged 0-3 days old (59.8 Per cent), while low birth weight (weight at birth between 1500g to less than 2500g) was observed in 39.2 Per cent of neonates, and 54.9 Per cent were females. The characteristics of the neonates are shown in Table 1.

Prevalence of Neonatal Hypoglycemia

The 204 participants included in our study, 18 had neonatal hypoglycemia with blood sugars < 45mg/dL, thus giving a prevalence of 8.8 Per cent Figure 1.

Description of socio-demographic characteristics of the mothers

Most of the mothers (67.2 Per cent) were aged 20 to 30 years, with 75.9 Per cent of them living as a couple; (85.3 Per cent) were literate with at least a primary level of education, and 56.4 Per cent had liberal professions.

Description of obstetric characteristics of the mothers

The duration of labour was <12hrs for the majority (64.2 Per cent) of women. The mode of delivery by Spontaneous Vaginal Delivery (SVD) was 68.1 Per cent, and Caesarean Section (CS) was 31.9 Per cent. Most pregnancies (87.7 Per cent) were single pregnancies. Of the mothers, 2.9 Per cent were known diabetics and 1 Per cent hypertensive. The description of maternal obstetric characteristics is shown in Table 2-5.

Diagnosis of neonates

Overall, neonatal infection was the most common reason why neonates were admitted to the neonatology unit of the hospital (45.6 Per cent), followed by prematurity and low birth weight (29.9 Per cent) and birth asphyxia (21.1 Per cent). Only 1.1 Per cent was admitted for intrauterine growth restriction. Of the neonates with hypoglycemia, majority (50 Per cent) were both premature and low birth weight, whereas, only 11, 1 Per cent of term neonates with low birth weight, and 5, 6 Per cent of premature babies without low birth weight had hypoglycemia, suggesting that being both premature and having a low birth weight was more likely to increase the risk of hypoglycemia in neonates, Figure 2.

Factors associated with hypoglycemia in the study population

From the neonatal characteristics, low birth weight (LBW) was the only independent variable which had a statistically significant association to the outcome with LBW neonates having 1.6 times more risk to develop hypoglycemia (COR 1.6; 95 Per cent CI 0.994-2.842). Prematurity was not found to have a statistically significant association (COR 0.755; 95 Per cent CI 0.347-1.643).

Maternal factors associated with hypoglycemia

For mothers who had neonates with hypoglycemia, majority (61.1 Per cent) were below 30 years of age; 77.8 Per cent were living as a couple, 88.9 Per cent were literate and 72.2 Per cent were employed.

None of the maternal obstetrical factors were statistically significant for neonatal hypoglycemia

Discussion

This study was aimed at determining the prevalence of neonatal hypoglycemia and identifying the risk factors associated. Evaluation of hypoglycemia in our context is not routinely done. There exist no consensus on the cut off value for neonatal hypoglycemia currently^{12,13}. This makes the situation even more challenging in our context given the fact that neonatal hypoglycemia has to be recognized on time, managed promptly so as to avoid the devastating side effects linked to hypoglycemia, especially on the brain. It is equally important to know the factors associated with neonatal hypoglycemia to be able to address them before we get to complications.

In our study, we found a prevalence of 8.8 Per cent of hypoglycemia which is far lower than the studies done in Nigeria and Ethiopia where they found 28 Per cent and 25 Per cent respectively. In the study in Nigeria, they included all neonates born in their hospital, whether they were sick or not. In the study done in Ethiopia, they used a higher cut off value for neonatal hypoglycemia of 47mg/dL¹⁴. We had a slightly higher prevalence of neonatal hypoglycemia than was seen in a study done in Iran where they found a prevalence of 6.1 Per cent among neonates admitted in their neonatal intensive care unit. This could be explained by the longer duration of their study over a 2-year period, and the different method they used for measuring blood glucose levels (glucose oxidase method with 4-aminophenazone with a Greiner G-300) by Abbott FreeStyle™ kit, USA¹⁵.

Concerning factors associated with neonatal hypoglycemia, there exist several risk factors. In our study, we found that birth weight less than 2500g was the most significant variable associated with neonatal hypoglycemia, an association which was independent from confounders. Other studies also found low birth weight as a risk factors such as; Bromiker, et al. in Israel in 2019 who found low birth weight, gestational age, maternal diabetes, and twin deliveries as factors associated with hypoglycemia. In their study, they found low birth weight not significant after multivariate analysis⁶. This could be explained by the fact that they considered a lower cut off range for hypoglycemia of 40mg/d. Also, Amponsah et al in Ghana in 2015 found low birth weight, Large for Gestational Age

(LGA), preterms, birth asphyxia, neonatal infection, caesarian section and time of breast feeding as risk factors¹⁶. Low birth weight neonates like premature babies have limited hepatic glycogen and fat stores due to inadequate substrate supply available for their synthesis. They equally have higher metabolic demands, relatively high blood insulin levels and are unable to mount a counter-regulatory responses to hypoglycemia¹⁷. These reasons could explain why hypoglycemia was found to be more among low birth weight neonates.

We did not find statistically significant associations with some risk factors that prior studies identified as predictors of risk, such as small for gestational age, large for gestational age neonates, premature neonates, birth asphyxia, and maternal diabetes mellitus¹⁸⁻²⁰. This is in contrast to our study, in which none of these factors seem to influence the odds of hypoglycemia. This could be explained by the small sample we had of neonates with low blood glucose measurements in our study.

In conclusion, our study found the prevalence of neonatal hypoglycemia to be 8.8 Per cent in neonates admitted in the neonatology unit. Low birth weight was the major factor that contributed considerably to the risk of hypoglycemia.

From our study, we can recommend monitoring the blood glucose systematically in high -risk babies with LBW. Further studies in our setting should be undertaken, because there still is a paucity of data on the subject in our context. Early detection of hypoglycemia in low birth weight neonates and timely management are very important in preventing long-term neurologic complications seen in neonates with neonatal hypoglycemia.

Conclusion

In conclusion, our study found the prevalence of neonatal hypoglycemia to be 8.8% in neonates admitted in the neonatology unit. Low birth weight was the major factor that contributed considerably to the risk of hypoglycemia.

Recommendation

From our study, we can recommend monitoring the blood glucose systematically in high -risk babies with with LBW. Further studies in our setting should be undertaken, because there still is a paucity of data on the subject in our context. Early detection of hypoglycemia in low birth weight neonates and timely management are very important in preventing long-term neurologic complications seen in neonates with neonatal hypoglycemia.

Limitations

We had some limitations in our study. We had a small sample size and we used just a screening test to measure the blood sugar.

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Tables and Figures

Table 1: Description of characteristics of neonates.

Variable	Number	Percentage
Age in days		
[0-3]	122	59.8
[3-7]	45	22.1
[7-28]	37	18.1
Gestational age		
Term	131	64.2
Preterm	63	30.9
Post term	10	4.9
Gender		
Male	92	45.1
Female	112	54.9
Birth weight		
<1000	7	3.4
[1000-1500]	23	11.3
[1500-2500]	80	39.2
[2500-4000]	84	41.2
>4000	10	4.9

Table 2: Description of maternal socio-demographic characteristics

Variable	Frequency	Percent
Maternal age		
<20	12	5.9
[20-30]	137	67.2
[30-40]	53	26
[40-50]	2	0.9
Civil status		
Single	49	24.1
Living as a couple	154	75.9
Level of education		
Illiterate	30	14.7
Literate*	174	85.3
Profession		
Unemployed	70	34.3

Liberal**	115	56.4
Non liberal***	19	9.3
*Literate: At least a primary education; **Liberal: Traders, business sector; ***Non liberal: Civil servants		

Table 3: Description of maternal obstetric characteristics.

Variable	Frequency	Percent
Maternal Diabetes Mellitus		
Yes	6	2.9
No	198	97.1
Maternal hypertension		
Yes	2	1
No	202	99
Mode of delivery		
Vaginal delivery	139	68.1
Caesarean section	65	31.9
Duration of labour		
<12 hours	131	64.2
>12 hours	73	35.8
Nature of birth		
Single	179	87.7
Multiple	25	12.3

Table 4: Factors associated with hypoglycemia in the study population.

Variable	Glycemia ≤45mg/dL N=18 (Per cent)	Glycemia >45mg/dL N=186 (Per cent)	COR	AOR	p-value
Age					
≤7	14 (77.8)	153 (82.3)	0.952	0.82	0.544
>7	4(22.2)	33 (17.7)	0.515-1.7517		
Gender					
Male	7 (38,9)	85 (45.7)	0.756	0.806	0.674
Female	11 (61.1)	101 (54.3)	0.271-2.036		
Gestational age					
Term	9 (50)	132 (70.9)	0.755	0.766	0.516
Preterm	9 (50) 54	54 (29.1)	0.317-1.643		
Birth weight (g)					
≤2500	15 (83.3)	95 (51.1)	1.681	1.749	0.043
>2500	3(16.7)	91 (48.9)	0.994-2.842		

Table 5: Maternal factors associated with hypoglycaemia.

Variable	Glycemia ≤45mg/dL N-18 (Per cent)	Glycemia >45mg/dL N=186 (Per cent)	COR	AOR	p-value
Age (years)					
≤30	14 (77.8)	153 (82.3)	0.952	0.82	0.544
>30	4(22.2)	33 (17.7)	0.515-1.7517		
Civil status					
Single	7 (38,9)	85 (45.7)	0.756	0.806	0.674
Living as a couple	11 (61.1)	101 (54.3)	0.271-2.036		
Level of education					
Literate	9 (50)	132 (70.9)	0.755	0.766	0.516
Illiterate	9 (50) 54	54 (29.1)	0.317-1.643		
Profession					
Unemployed	15 (83.3)	95 (51.1)	1.681	1.749	0.043
Employed	3(16.7)	91 (48.9)	0.994-2.842		
Mode of delivery					
SVD	11 (61.1)	128 968.8)	0.712	0.631	0.392
CS	7 (38.9)	58 931.2)	0.263-1.930		
Nature of birth					
Single	16 (88.9)	163 (87.6)	1.129	1.251	0.78
Multiple	2 (11.1)	23 (12.4)	0.244-5.231		
Duration of labour (hours)					
<12	10 (55.6)	121 (65.1)	0.671	0.614	0.345
>12	8 (44.4)	65 (34.0)			

Figure 1: Prevalence of hypoglycaemia in neonates.

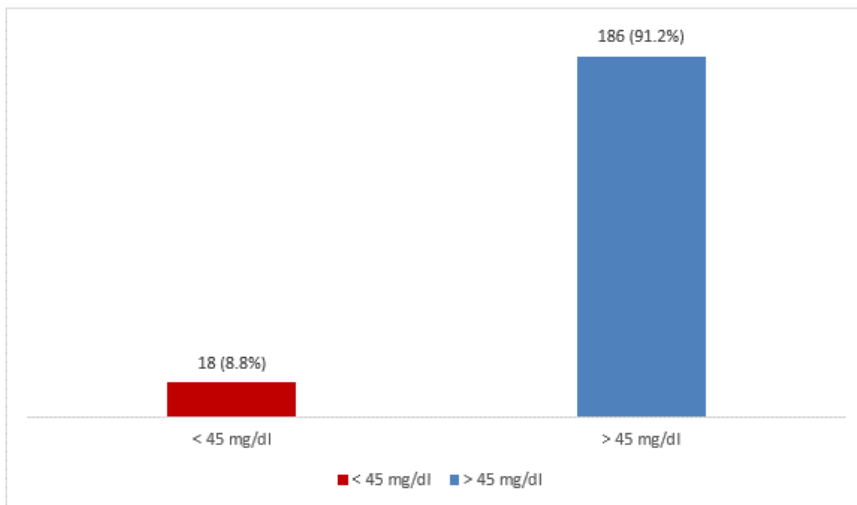


Figure 2: Diagnosis on admission.

