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Original Research Article

Neonatal Hypoglycaemia: Prevalence and Clinical Outcome in a Tertiary Health Facility in North-Central Nigeria

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ABSTRACT

Background: Hypoglycaemia is one of the recognized medical emergencies in a neonatal unit. The diagnosis of neonatal hypoglycaemia requires a high index of suspicion due to the fact that it presentation is protean. Early diagnosis and treatment could prevent long term complications, and death. The aim of the study was to determine the prevalence of hypoglycaemia, the associated risk factors and the clinical outcome among neonates admitted into the neonatal unit of Dalhatu Araf Specialist Hospital (DASH), Lafia.
Materials and Method: This was a descriptive cross-sectional study conducted between 1st of January 2018 and 30th of June 2018. Neonates admitted into the unit with various medical conditions had their random blood sugar (RBS) done at presentation using rapid glucose test strip mounted on ACCU-CHEK (Active) glucometer device. Neonatal clinical parameters, maternal obstetrics parameters and maternal socio-demographics features were recorded based on a predesigned proforma.
Results: A total of 220 neonates were studied out of which 67 neonates had hypoglycaemia (<2.6 mmol/l), giving a prevalence of 30.5%. Hypoglycaemia was significantly associated with macrosomic neonates and neonates who were not on oral feeds at presentation ($p<0.05$).
Conclusion: The prevalence of hypoglycaemia among sick neonates was found to be high with macrosomic neonates and neonates who were not on oral feeds at presentation been particularly at risk. Routine screening of sick neonates for hypoglycaemia should be re-emphasized.

Key words: *Hypoglycaemia, Neonates, Prevalence, Lafia*

INTRODUCTION

Hypoglycaemia is one of the commonest metabolic emergencies in a neonatal unit.[1] The diagnosis of neonatal hypoglycaemia requires a high index of suspicion due to the fact that its presentation is protean. Hypoglycaemia if not recognized and treated promptly can result to long term complications such as seizure disorder, cerebral palsy, learning disability, developmental problems or even death.[2-4]

Glucose is the main source of fuel to the brain. The glucose requirement of the brain is about 90% of the total glucose requirement in neonates.[5] Due to its important role in cerebral metabolism and other metabolic functions; blood glucose is tightly regulated by neuro-hormonal mechanisms. There is usually a surge in blood glucose immediately after feeds, and this gradually begins to drop as insulin level increases in response to the glucose concentration. Insulin increases glucose

uptake and storage as glycogen in the skeletal muscles, liver and adipose tissues. During fasting, counter-regulatory hormones which include glucagon, epinephrine and cortisol stimulate glycogenolysis and gluconeogenesis, primarily in the liver and kidneys, while lipolysis is stimulated in adipose tissue, in order to maintain blood glucose. However, these counter-regulatory mechanisms are not fully matured in neonates, and as a result, hypoglycaemia can be quite profound and prolonged.[5,6]

Early recognition and prompt treatment of neonatal hypoglycaemia can prevent mortality and long term complications. The reported prevalence of hypoglycaemia varies from centre to centre depending on the cutoff values of blood glucose for the diagnosis of hypoglycaemia. The prevalence of neonatal hypoglycaemia and its outcome in the present facility is unknown. The study was carried out to determine the prevalence of neonatal hypoglycaemia, the associated risk factors, and the clinical outcome.

MATERIALS AND METHODS

This was a descriptive cross-sectional study conducted between 1st of January 2018 and 30th of June 2018 in DASH, Lafia. The hospital is a tertiary health facility located in Lafia, North central Nigeria. It serves as a referral centre for Nasarawa state, and parts of the surrounding states of Benue, Plateau and Kaduna. Ethical approval from the Ethics and Research committee was sought and obtained for the study. Informed consent was also obtained from caregivers of neonates. Neonates admitted into the neonatal unit with various medical conditions had their random blood sugar (RBS) done at presentation using rapid glucose test strip mounted on ACCU-CHEK (Active) glucometer device. The right or left heel of neonates was disinfected using a cotton wool and 70% methylated spirit. The disinfected site was allowed to air dry in 30 seconds and then a sterile lancet was used to prick the heel. As blood pooled from the puncture site, a glucose test strip mounted on Accu CHEK (Active) glucometer was used to make contact with blood from the puncture site and the blood sugar is displayed in about 10 seconds.

Neonates with RBS less than 2.6 mmol/L were considered to be hypoglycaemic and were treated.[7,8] Treatment of hypoglycaemia was with 4 ml/kg of 10% Dextrose water.[9] Neonates treated for hypoglycaemia were maintained on intravenous fluid at a glucose rate of 6 mg/kg/minute. Neonates who could tolerate feeds were fed 2 hourly or on demand. Repeat RBS was done after 30 minutes for babies who were treated for hypoglycaemia, and where repeat RBS was found to be less than 2.6mmol/L, the treatment for hypoglycaemia was repeated. Social-economic classification was done using both parents' educational status and occupation according to Oyedeji Social-Economic Classification.[10] Socio-economic class, obstetric data, neonatal clinical parameters and diagnosis were documented based on a predesigned proforma (Appendix I). Data was collected into Microsoft Excel sheet and data analysis was by SPSS version 23. Chi square was used to test for level of significance, and a p value <0.05 was considered significant.

RESULTS

A total of 220 neonates were studied, out of which males and females were each 110 with a ratio of 1:1. One hundred and fifty-seven (71.2%) neonates were delivered term and 63 (28.8%) neonates were delivered preterm. One hundred and fourteen (51.8%) neonates were delivered vaginally, while caesarean section accounted for 106 (48.2%) deliveries. One hundred and ninety-eight (90%) neonates were delivered in the hospital, while 22 (10%) neonates were delivered at home. Table I shows the distribution of neonates into social classes, modes of delivery and places of delivery.

Table 1: Distribution into Social classes, Modes of delivery and Places of delivery

Social Classes		
Upper Class	23	9.2
Middle Class	67	31.8
Lower Class	130	59.0
Modes of Delivery		
Vaginal Delivery	114	51.8
Abdominal Delivery	106	48.2
Places of Delivery		
Hospital	198	90.0
Home	22	

Table II shows the mean and range of neonatal weight, neonatal age and maternal age. The mean admitting weight of neonates was 2.6 ± 0.6 Kg; the mean gestational age was 38.2 ± 3.0 weeks; the mean chronological age was 58. 2 ± 116.2 hours, and the mean maternal age was 27.0 ± 5.4 years.

Table II: Mean and Range of Neonatal Age, Neonatal Weight and Maternal Age

Neonatal Weight (Kg)	2.6 ± 0.8	0.7-4.9
Gestational Age (Wks)	38.2 ± 3.1	26-42
Chronological Age (Hrs)	58.2 ± 116.2	0.5-614
Maternal Age (Years)	27.0 ± 5.4	16-42

Sixty-seven (30.5%) neonates had hypoglycaemia with a RBS less than 2.6 mmol/L The mean RBS of neonates was 3.9±2.2 mol/L. Table IV shows the mean and range RBS of various groups of neonates. There was a statistically significant difference between RBS of preterm neonates and term neonates with a p value = 0.03.

Table III: Comparison of the Mean and Range RBS of Groups

Males Females	3.9±2.1 4.0±2.4	-480	0.600
Term Preterm	4.1±2.5 3.5±1.5	- 2.2	0.030
Weight < 2.5 Kg Weight 2.5-3.9 Kg > 4.0 kG	3.5±1.2 4.5±2.7 3.2±1.8	-3.3	0.002
Feeding Feeding Intolerance	4.5±2.0 3.6±2.3	3.1	0.002
NNS Asphyxia RDS	3.9±1.8 4.5±3.1 3.7±1.6	-846	0.200

Table IV shows the association between variables and hypoglycaemia with significant association found between hypoglycaemia and feeding intolerance and macrosomia. The table also shows that mortality was significantly associated with hypoglycaemia.

Table IV: Association between variables and hypoglycaemia.

Variable	Hypoglycaemic (%)	Non- Hypoglycaemic(%)	Total	X^2	df	P value
Upper Class Middle Class Lower Class	02(3.4) 23(39.0) 34(57.6)	16(11.9) 39(28.9) 80(59.2)	194	4.5	2	0.16
Males Females	39(58.2) 28(41.8)	71(46.7) 82(53.3)	220	2.5	1	0.117
Preterm Term	18(27.3) 49(72.7)	45(29.6) 108(70.4)	220	0.1	1	0.727
Weight <2.5 Kg Weight ≥2.5 Kg	34(50.0) 33(50.0)	63(41.1) 91(58.9)	220	1.5	1	0.222
In-born Out-born	37(55.2) 30(44.8)	89(58.6) 64(41.4)	220	0.1	1	0.646
Feeding Poor Feeding	11(16.4) 56(83.6)	77(50.7) 76(49.3)	220	22.7	1	< 0.001
RDS Asphyxia NNS Macrosomia Others	08(11.9) 18(26.9) 23(34.3) 11(14.9) 07(11.8)	32(20.4) 36(23.7) 71(46.7) 09(5.9) 06(3.3)	220	13.9	4	0.008
Survived Died	57(86.6) 10(13.4)	143(94.7) 10(5.3)	220	4.3	1	0.037

DISCUSSION

The prevalence of hypoglycaemia in the present study was high. This finding is comparable to findings from the study carried out in Ilesa, where a prevalence of 32.7% was reported.[11] However, a study carried out in Port Harcourt found a lower prevalence of 28.3%,[12] and a study carried out in Benue had a much lower prevalence of 11%.[13] A study carried out in Nepal, an Asian country, reported a high prevalence of 41%.[14] These disparities in prevalence

could be due to the inclusion criteria of the studied populations. The studies carried out in Port Harcourt and Benue used apparently healthy neonates at birth, while the present study and the study carried out in Ilesa used neonates at the point of admission for various clinical conditions. Sick neonates have been reported to be at significant risk of hypoglycaemia when compared to healthy neonates because of the effect of the illness on blood glucose and the fact that most sick neonates poorly tolerates feeds.[15]

Another possible explanation for the disparities in prevalence could be the cutoff value for diagnosing hypoglycaemia. The studies done in Port Harcourt and Benue used a lower reference point to diagnose hypoglycaemia (<2.2 mmol/L). The present study and that of Ilesa used a higher reference value. Nepal, a low income and underdeveloped country reported a higher prevalence of hypoglycaemia among apparently healthy neonates, using a cutoff value of < 2.6 mmol/L. In recent times, due to available evidence of the devastating effect of low blood glucose on the brain of neonates, higher values of RBS are now been used to make diagnosis of hypoglycaemia. Lucas *et al* followed up more than 600 preterm infants and demonstrated that although plasma glucose levels of <2.6mmol/L were common in newborns period, however persistence of these low levels for 5 or more days was associated with increase in cerebral palsy and developmental delay.[16] Current data suggest values of <2.6 mmol/L for reporting hypoglycaemia, and a value of <2.8 mmol/L for operational purpose of intervention.[17,18] The high prevalence of hypoglycaemia from the present study shows that hypoglycaemia is a common metabolic complication of sick neonates.

Hypoglycaemia was significantly more associated with macrosomic neonates of non diabetic mothers when compared with neonates with normal birth weight, and neonates with low birth weight. Macrosomia is a recognized cause of transient hypoglycaemia as reported in a study in Tanzania.[19] Also, a study done in the United States found the prevalence of hypoglycaemia to be higher among large for gestational age neonates when compared to small for gestational age neonates.[20] Macrosomic neonates of non-diabetic mothers have been shown to have hyperplasia of the islet cells of the pancreas. The reason for the islet cell hyperplasia in this group of neonates was not certain but it was not connected to exposure to abnormally elevated levels of glucose in utero as seen in infants of diabetic mothers.[21] Macrosomic infants of non diabetic mothers have hyperinsulinaemia at birth when compared to non macrosomic infants.[22] Severance of the placenta blood supply at birth results to rapid development of hypoglycaemia due to hyperinsulinaemia.

Also, the present study has shown that neonates who had feeding intolerance were more likely to present with hypoglycaemia when compared to neonates who were tolerating feeds. This finding is consistent with the report by Deleke et al[11] and Pal *et al*.[14] Documented evidence reveals that neonatal glucose reserves are rapidly depleted during feeding challenges because of limited capacity to store glucose.[23] The above reasons underscores the importance of early and frequent breastfeeding as recommended by UNICEF and WHO in the Baby- friendly Hospital Initiatve.[24]

The present study also revealed that preterm neonates and low birth weight neonates had lower RBS when compared to term neonates and normal birth weight neonates respectively. Previous studies have revealed a similar finding.[11-13] Preterm neonates have limited glycogen and fat stores, have higher metabolic demands due to a relatively larger brain size, and are unable to mount a counter-regulatory response to hypoglycemia.[25] These groups of neonates must be provided with adequate calories and warmth to protect them from the devastating effects of hypoglycaemia on their developing brain.

Obstetric factors like modes of delivery and places of delivery were found not to be associated with hypoglycaemia. A similar finding has been reported in the literature.[11,13] Neonatal sepsis, asphyxia and neonatal jaundice were not found to be significantly associated with hypoglycaemia. A similar finding has been reported by Deleke *et al*.[11]

Mortality was significantly more associated with hypoglcaemia with 50% of the mortalities presenting with hypoglycaemia in the present study. A similar finding was reported by Deleke et al[11] and Ogunlesi Tinuade.[26] Hypoglycaemia is a recognized cause of mortality if not treated promptly. Though hypoglycaemia has multi-organ affectation when prolonged, its most devastating effect is seen in the brain where it causes functional brain failure and subsequent brain death.[27]

CONCLUSIONS

Neonatal hypoglycaemia was found to be a common complication of neonates admitted into the neonatal unit with macrosomic neonates and neonates with feeding intolerance been particularly at risk. Therefore, routine screening for early detection and prompt treatment of hypoglycaemia among sick neonates is reemphasized.

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APPENDIX I

PROFORMA FOR PREVALENCE, RISK FACTORS AND CLINICAL OUTCOME OF NEONATAL HYPOGLYCAEMIA IN DASH, LAFIA

Hospital Number: ……
Gestational Age: ……..
Gender: ……
Weight: ……
Age (Hours): ……..
Apgar Scores: ……..
Mode of Delivery: ……..
Booking Status: ……
Place of Delivery: …….
Maternal Age: ……
Parity: ……
Social Class (Source-Admission Register): ……
Clinical Diagnosis: ……
Nutrition: a) NPO b) B/feeding
c) Breast milk substitute
Random Blood Sugar at presentation: ……
Treated for hypoglycaemia: a) Yes b) No
Repeat RBS after 30 minutes: ……
Outcome of admission: a) Discharged
b)SAMA c)Death

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