HYPOGLYCEMIA IN SMALL FOR GESTATIONAL AGE NEONATES BASED ON GESTATIONAL AGE, GENDER, BIRTH WEIGHT AND MODE OF DELIVERY

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ABSTRACT

Objective: To determine the frequency of hypoglycemia in small for gestational age neonates based on gestational age, gender, birth weight and mode of delivery.

Study Design: Cross sectional study.

Place and Duration of Study: Neonatal Intensive Care Unit (NICU), Military Hospital Rawalpindi, from Dec 2011 to Jul 2012.

Material and Methods: We included 383 small for gestational age (SGA) neonates admitted in NICU. Blood glucose levels were checked in all neonates. Variables included in study were gestational age, gender, birth weight and mode of delivery.

Results: Out of 383 SGA neonates enrolled by non-probability consecutive sampling, 191 (49.87%) were males and 192 (50.13%) were females. Out of these 203 (53%) were preterm, 165 (43.08%) were delivered at term and 15 (3.92%) were post-term SGA neonates with mean gestational age of 34 weeks 5 days. Out of the total 383 SGA neonates 208 (54.31%) developed hypoglycemia during stay in NICU and 175 (45.69%) remained euglycemic. Extremely low birth weight (ELBW) neonates were at highest risk to develop hypoglycemia (82.35%). It was seen that SGA neonates delivered by instrumental vaginal delivery had highest risk of developing hypoglycemia i.e. 20 (76.92) out of 26 neonates. Out of 103 vaginal deliveries 41 (39.81%) had hypoglycemia and out of 254 Caesarean section 147 (57.87%) had hypoglycemia.

Conclusion: Low birth weight neonates delivered by instrumental vaginal delivery were found to be at a higher risk of developing hypoglycemia.

Keywords: Birth weight, Gender, Hypoglycemia, Mode of delivery, Newborn, Small for gestational age.

INTRODUCTION

Hypoglycemia is a commonly seen metabolic anomaly in Neonates. Lowest blood glucose value is seen at 2 hours of age which is now considered more of physiological hypoglycemia than pathologic[1-3]. Early breast feeding is essential to prevent hypoglycemia. Regular monitoring of blood glucose levels by rapid methods like heel stick helps prevent long standing hypoglycemia and thus its sequelae. A blood glucose determination should always be performed in all neonates during neonatal evaluation and in all sick neonates at regular intervals who should be vigorously treated if found to have blood glucose concentration below 50mg/dl[1].

SGA neonates are prone to develop hypoglycemia because of their small reserves and immature metabolic pathways. After birth continuous trans-placental infusion of glucose is interrupted. Neonates' brain and vital organs need continuous supply of glucose to meet nutritional requirements, in term neonates this is achieved by hormonal and metabolic adaptive changes but premature and SGA infants are vulnerable to develop hypoglycemia because of lack of these adaptive changes and premature metabolic pathways[1]. During the first week of life, preterm, low birth weight (LBW) and SGA neonates are at high risk of abnormal glucose homeostasis including both hypoglycemia as well as hyperglycemia[1,2].

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Out of all live born neonates 26% have LBW and 17% are SGA[4]. Frequency of hypoglycemia as reported in literature in SGA neonates is 53%. Male babies are more prone to develop hypoglycemia (55.3%) as compared to females (50.7%)[5]. Hypoglycemia in neonates can lead to epilepsy[6,7]. Neonatal hypoglycemia ismore common than normally believed and can cause severe neurological sequelae. Patients suffering from hypoglycemia can develop epilepsy, mentalretardation, cerebral palsy and visual disturbances. Monitoring of hypoglycemia is essential in first 3 days of life in high risk patients[8].

There is no exact value of glucose below which irreparable brain damage occurs[9]. Since symptomatic hypoglycemia in neonates is associated with 50% chances of permanent brain damage, in this study risk factors causing hypoglycemia were indentified. If we are more aware regarding risk factors, babies can be picked before they develop symptomatic hypoglycemia and permanent brain damage.

MATERIAL AND METHODS

This cross sectional study was carried out in Neonatal Intensive Care Unit (NICU), Department of Paediatrics, Military Hospital Rawalpindi from 8th Dec 2011 to 7th July 2012. Sample size was calculated using world health organization (WHO) calculator, confidence level 95%, absolute precision 5%, anticipated population proportion 53%. Sample Size (n) obtained was 382. So, total of 383 (n) SGA neonates admitted in NICU were included in the study by consecutive (non probability) sampling. All SGA neonates presenting within 4 hours of life whether indoor or outdoor were included in the study except those with congenital anomalies, malformations or syndromic appearances, those who died or required mechanical ventilation within first 4 hours of life. Permission from the concerned authorities and ethical committee was sought. Parents were explained about the risks and benefits of the study and informed written consent was obtained according to the guidelines of Helsinki Declaration. Permission was also obtained regarding use of data for research and publication. All small for gestational age neonates, meriting inclusion criteria were included in the study. Appropriate entries were made in study register. Data was collected regarding gestational age, gender, mode of delivery and birth weight through history and physical examination. Exact weight was recorded. Weighing machine was zeroed prior to measurement and baby was weighed naked separated from the surface of machine by a sterile towel, weight of which was excluded from baby's weight. Baby's weight was plotted on the standard percentile chart for gestational age. Blood glucose level was checked in heel prick capillary blood sample using a reflectance method (glucometer) at 4 hours of age and every 8 hourly afterwards during stay in NICU. In all symptomatic neonates blood glucose was checked in addition to 8 hourly monitoring. SGA Neonates who tolerated initial feedings and had normal blood glucose at 4 hours of age were detained for further 2 feeds in NICU, blood glucose was checked once more and those who remained euglycemic were shifted to mother based care and were included in euglycemic group. Neonates who had hypoglycemia during this initial evaluation were given either enteral or parenteral treatment and were admitted in NICU for further evaluation as mentioned above. Any reading below 50mg/dl was considered hypoglycemia. Data was collected through a structured proforma (Annex A). Confidentiality of the patient record was maintained.

All data were entered and analyzed using SPSS version 16. Frequency of hypoglycemia among small for gestational age neonates was calculated based on age, gender, gestational age and mode of delivery. Descriptive statistics was used to analyze and describe data. Frequency and percentage was calculated for categorical (qualitative) variables like hypoglycemia, gender, gestational age, birth weight and mode of delivery. Chi-square test was applied to calculate *p*-value for each variable.

RESULTS

Out of 383 SGA neonates 191 (49.87%) were males and 192 (50.13%) were females. Gestational age wise 203 (53%) were preterm, 165 (43.08%) were delivered at term and 15 (3.92%) were post-term SGA neonates with mean gestational age of 34 weeks 5 days with SD of 4 weeks 2 days. On the basis of birth weight 230 (60.05%) neonates were delivered with LBW, 102 (26.63%) were delivered with VLBW and 51 (13.32%) had ELBW. Mean birth weight was 1.66 kgs with 0.43kgs SD. Most babies were delivered by caesarean section, 254 (66.32%), 103 (26.89%) were delivered by normal vaginal delivery and 26 (6.79%) required instrumental assistance during vaginal delivery.

Out of 383 SGA neonates 208 (54.31%) developed hypoglycemia during stay in NICU and 175 (45.69%) remained euglycemic (p=<0.001) compared to 3% incidence of hypolycemia in normal born neonates[1]. Out of 191 males 110 (57.59%) developed hypoglycemia and out of 192 females 98 (51.04%) had hypoglycemia (p=0.198) thus failed to establish association between hypoglycemia and gender.

Preterm neonates were more prone to develop hypoglycemia (p<0.001). Out of 203 preterm SGA babies 148 (72.91%) developed hypoglycemia compared to 58 (35.15%) out of 165 term SGA neonates and 2 (13.33%) out of 15 post-term neonates.

ELBW neonates were at highest risk to develop hypoglycemia (p<0.001). Out of 230 LBW neonates 98 (42.61%) had hypoglycemia, 68 (66.67%) out of 102 VLBW neonates developed hypoglycemia and 42 (82.35%) had hypoglycemia out of 51 ELBW neonates.

It was seen that SGA neonates delivered by instrumental vaginal delivery had higher risk of developing hypoglycemia i.e. 20 (76.92) out of 26 neonates (p<0.001). Out of 103 vaginal deliveries 41 (39.81%) had hypoglycemia and out of 254 Caesarean section 147 (57.87%) had hypoglycemia (table).

Table: Hypoglycemia in small for gestational age neonates based on gender, gestational age, birth weight and mode of delivery.

		Hypoglycemia					
		N	Present		Absent		p-value
Total		383	208	54.31%	175	45.69%	<0.001
Gender	Male	191	110	57.59%	81	42.41%	=0.198
	Female	192	98	51.04%	94	48.96%	
Gestational age	Preterm	203	148	72.91%	55	27.09%	<0.001
	Term	165	58	35.15%	107	64.85%	
	Post-term	15	2	13.33%	13	86.67%	
Birth weight	Low birth weight	230	98	42.61%	132	57.39%	<0.001
	Very low birth weight	102	68	66.67%	34	33.33%	
	Extremely low birth weight	51	42	82.35%	09	17.65%	
Mode of delivery	Vaginal delivery	103	41	39.81%	62	60.19%	<0.001
	Instrumental vaginal delivery	26	20	76.92%	6	23.08%	
	Caesarean delivery	254	147	57.87%	85	42.13%	

DISCUSSION

Sirinavasan et al[10] conducted study on plasma glucose values in normal neonates and concluded that blood glucose level in the healthy term newborn falls during the first two hours after delivery, reaching rarely below 40 mg/dl at 2 hours of life and stabilizes at 4-6 hours of life in the range of 45 to 80 mg/dl. After delivery plasma glucose level is maintained by the breakdown of glycogen due to increased epinephrine and glucagon activity and falling insulin levels. Plasma glucose level is also maintained by the synthesis of glucose from lactate, glycerol, and amino acids (gluconeogenesis). As feeds with adequate

carbohydrate are established, maintenance of plasma glucose concentrations is no longer solely dependent on gluconeogenesis. So blood glucose was determined at 4 hours of age and any low reading earlier than this was considered physiological drop in glucose concentration.

Hawdon et al[11] states that hypoglycemia typically occurs with in the first 10 hours after birth. SGA infants become predisposed to hypoglycemia in utero as low intrauterine insulin concentrations result in decreased glycogen synthesis and stores. After delivery, a poorly coordinated response of counter-regulatory hormones and peripheral insensitivity to these hormones may contribute to hypoglycemia in some infants. So its not solely failure of establishment of feeding that leads to hypoglycemia rather a multiple factors contribute towards development of hypoglycemia in SGA neonates.

Transient hypoglycemia is common in neonates as the source of glucose changes from a continuous supply from placenta to the intermittent supply from feeds. Although transient asymptomatic hypoglycemia in healthy infants is part of the normal transition to extrauterine life, persistent or recurrent hypoglycemia can cause neurologic sequelae[12]. It is difficult to define exact numerical value of pathologic neonatal hypoglycemia. Transient hypoglycemia normally occurs after birth and most neonates are asymptomatic, however, some are symptomatic at the same or even higher blood glucose levels. This variability is due to gestational age, postnatal age, the presence of other sources of energy (eg, ketone bodies) and other factors that affect glucose metabolism[13,14]. Hypoglycemia is defined as any blood glucose concentration below 50mg/dl[1]. Glucose concentration measured in whole blood is approximately 15 percent lower than that in plasma and may be further reduced if the hematocrit is high.

We conclude that SGA neonates are much more vulnerable to hypoglycemia compared with healthy neonates (p<0.001), there is no gender predilection for hypoglycemia in SGA babies, smaller the baby gestation wise or weight wise higher is the probability of hypoglycemia and neonates delivered through C-section are also more prone to develop hypoglycemia compared to vaginally delivered SGA babies (p=0.001).

CONCLUSION

Low birth weight neonates delivered by instrumental vaginal delivery were found to be at a higher risk of developing hypoglycemia.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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