Original Research Article

Serum glucose levels in preterm neonates during the first 72 hours of life

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Abstract

Background: Postnatal hypoglycemia is common in preterm neonates. The assessment of blood glucose has become an inherentpart of basic neonatal care in many centres. **Aim:** To provide useful data for the prevention and treatment of hypoglycemia in preterm infants by investigating blood glucose levels during the first72 hours of life after birth, as well as the prevalence of and risk factors for these conditions. **Material and Methods:** A total of 125preterm babies were studied for incidence of hypoglycemia.BSL was done at regular intervals 0, 3, 6, 12, 24, 48, 72 hours. **Results:** Among 125 preterm neonates, 28 (16.47%) had hypoglycemia.107 were preterm AGA, out of which 23 (21.5%) babies had hypoglycemia. 18 were preterm SGA, out of which 5 (27.78%) babies had hypoglycemia. 7 (25%) babies had septicemia followed by hyperbilirubinemia in 6 (18.75%) and birth asphyxia in 5 (21.88%) babies. **Conclusion:** Preterm babies are more prone to hypoglycemia and the episodes are maximum during first 0-24 hours. Among all perinatal and postnatal stress factors, incidence of hypoglycemia is more common in septicemia and birth asphyxia.

Key Words: Preterm, Blood glucose level, Hypoglycaemia, Gestational age, Septicaemia.

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INTRODUCTION

Neonatal hypoglycemia is one of the most common problems seen in neonatal intensive care units. Preterm and SGA infants are more prone for hypoglycemia as they have limited supplies and stores of energy sources for carbohydrate metabolism. In addition, the organs involved in the regulation of energy metabolism, which include the liver, pancreas, brain, and endocrine organs, are immature.[1] Persistent and recurrent hypoglycemia in preterm and SGA neonates is associated with long-term neurological complications such as visual defects,[2] localization-related epilepsy,[3] and cognitive dysfunction.[4] The assessment of blood glucose has become an inherent part of basic neonatal care in many centres. Interpreting blood glucose levels of infants continues to be a challenge for paediatricians. The present study aimed to provide useful data for the prevention and treatment of hypoglycemia in preterm infants by investigating blood glucose levels at 0, 3, 6, 12, 24, 48 and72 hours of life after birth, as well as the prevalence of and risk factors for these conditions.

MATERIAL AND METHODS

Preterm infants born with gestational age less than 37 weeks at a tertiary care health centre over a period of one year were enrolled in this study. Out of 170 neonates delivered, 125 (74%) were preterm and 45 (26%) were term babies. These 125preterm babies were studied for incidence of hypoglycemia and blood glucose levels were monitored at 0, 3, 6, 12, 24, 48 and72 hours of life after birth. We defined "term" as delivered at37–42 weeks gestation, based on maternal dates. Birth weight was defined as AGA on the basis of Usher's chart.[5]Approval from Institutional ethical committee was obtained.

Inclusion Criteria

a. Preterm babies delivered in this hospital and included:

i. Babies born with gestational age less than 37 weeks.

ii. Babies with perinatal and postnatal risk factors.

b. Preterm babies required NICU admission.

Exclusion Criteria

a. Babies delivered outside this hospital (outborn).
b. Babies with weight < 1000 gm.
c. Babies received steroids or adrenergic drugs any time in 1st 72 hours.
d. Babies required GIR > 8 mg/Kg/ min.
e. Babies of diabetic mother.

Methodology

Blood glucose levels were measured irrespective of feeding time at regular intervals of 0, 3, 6, 12, 24, 48, 72 hours. Depending upon the birth history, clinical examination, laboratory investigation, perinatal and postnatal risk factors decided. As sugar monitoring was continued upto 72 hours, diagnosis was established at the end of the 72 hours. Their correlation with hypoglycemia studied. Maternal RBS was also measured before or at the time of delivery to rule out hyperglycemic state in mother. It helped in ruling out hyper insulinic state in neonate. So, the study was done to find approximate incidence of hypoglycemia in high risk newborns. Whole blood samples were obtained from the heel using dextrostix, meanwhile the glucometer was started. If glucometer showed blood sugar level in the range of hypo/ hyperglycemia this reading was rechecked by glucose oxidase perioxide method from laboratory. If required treatment was given in the form of increased GIR and IV boluses or regular feedings. All these babies were observed for the symptoms associated with hypoglycemia. Their correlation with low blood sugar level was established. Babies who required steroids or adrenergic drugs for treatment were excluded as those agents to alter the sugar levels.

RESULTS

Out of 170 neonates, 125 (74%) were preterm and among 125 preterm neonates, 28 (16.47%) had hypoglycemia.

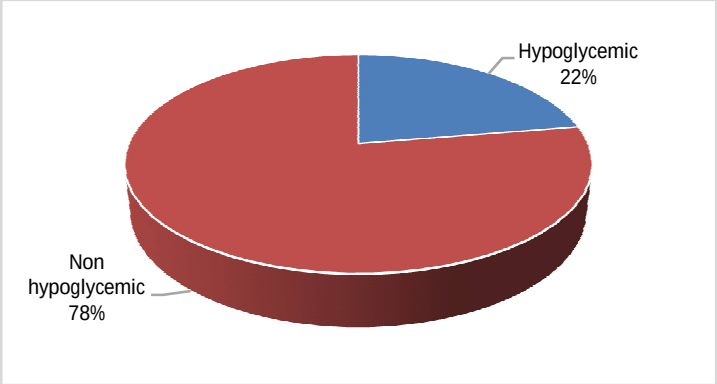

Figure 1: Preterm babies (n=125)

In present study, 107 were preterm AGA, out of which 23 (21.5%) babies had hypoglycemia. 18 were preterm SGA, out of which 5 (27.78%) babies had hypoglycemia.

Table 1: Blood sugar levels according to gestational age

Maturity	Gestational Age	Blood Sugar Levels		Total
		Hypoglycemia	Normal	
Preterm	AGA	23 (21.50%)	84 (78.50%)	107 (100%)
	SGA	05 (27.78%)	13 (72.22%)	018 (100%)
Total		**28 (18.82%)**	**97 (81.18%)**	**125 (100%)**

Out of 170 babies, 125 were low birth weight babies, of which 19 (11.17%) babies had hypoglycemia, 16 babies of them were weighing between 1.5–2 kgs (9.41%) and 3 babies were weighing between 2–2.5 kgs (1.76%). The difference was statistically not significant (P=0.3451).

Table 2: Hypoglycemia related to gestational age and duration in hours of episode

	Gestational Age	Hypoglycemia		Duration in Hours of Episode		
		No	Yes	0–24	24–48	48–72
Preterm (n=125)	SGA (n=18)	13	5	4	1	1
	AGA (n=107)	84	23	15	5	3
Total (n=125)		**97**	**28**	**19**	**6**	**4**

Maximum 19 episodes of hypoglycemia were seen in first 24 hours (67.8%). As one of the preterm SGA baby had second episode during 48–72 hours of life. During second day (24–48 hours) 6 episodes of hypoglycemia were documented (21.4%). During 48–72 hours of life (3rd day) 4 episodes (14.2%) were documented.

Table 3: Hypoglycemia related to Gestational Age, Maturity and Diagnosis (n=32)

Maturity	Gestational Age	BA	HBN	IUGR	MAS	RDS	Sepsis	Only preterm	Total
Preterm	SGA	1	2	1	0	0	1	0	5
	AGA	4	4	0	0	3	6	6	23
Total		**5**	**6**	**1**	**0**	**3**	**7**	**6**	**28**

(BA=Birth Asphyxia; HBN=Hyperbilirubinemia; IUGR=Intrauterine Growth Retardation; MAS=Meconium Aspiration Syndrome; RDS=Respiratory Distress Syndrome).

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The above table shows that out of 28preterm hypoglycemic babies, 7 (25%) babies had septicemia followed by hyperbilirubinemiain 6 (18.75%) and birth asphyxia in 5 (21.88%) babies.

DISCUSSION

Preterm neonates have a lower glycogen storage capacity than full-term neonates. The response of hormones regulating blood glucose levels is less sensitive shortly after birth, because of the immaturity of cyclic adenosine monophosphate, a second messenger related to glucose metabolism. Therefore, postnatal hypoglycemia is common in preterm neonates. In present study, out of 170 neonates, 125 (74%) were preterm and among 125 preterm neonates, 28 (16.47%) had hypoglycemia.Thus, the incidence of hypoglycemia in preterm babies was 22.4%.The reason for increased incidence among preterms is low substrate stores, immature hormone and enzyme responses, fluid and energy restriction and feeding difficulties.[6] It is also likely that gluconeogenic pathways are less mature in preterms than in term babies.[7] In our study, out of 170 neonates, preterm AGA babies were 107 out of which 23 (21.50%) babies had hypoglycemia. Out of 18 preterm SGA babies, 5 (27.78%) babies had hypoglycemia.Thus, incidence of hypoglycemia in preterm SGA group was highest followed by preterm AGA then term SGA.Similarly, Lubchenco LO*et al*have also found maximum incidence in preterm SGA group i.e. 67% and 25% in term SGA group.[8] The incidence of hypoglycemia in term AGA was 10% in their study.Ward Platt MP and Hawdon JM found that increase blood levels of lactate and other total gluconeogenic substrates persisted until the fourth post–natal day in preterm SGA infants. But fell within the first 24 hours in term SGA infants thereafter being lower than those of AGA infants.[9] This seems consistent with the hypothesis that elevated concentrations of gluconeogenic substrate reflect delayed maturation of gluconeogenic pathways in SGA infants particularly those born preterm. In our study, we found that the mean blood sugar level was lowest during the 3rd hour of life. For AGA, it was 58.3% while in SGA babies it was 58.89%. Statistically difference was extremely significant ($p< 0.0001$). This initial fall of blood sugar level is explained as after cutting umbilical cord baby is entirely dependent upon its own resources to maintain fuel supply. Glycogenolysis is initial counter–regulatory process and when it is exhausted substrates are mobilized by proteins and fat stores, so gluconeogenesis occurs. These processes are induced by counter–regulatory hormones (glucagon, catecholamine, growth hormone and cortisol). The finding in our study was similar with the study conducted by Tanzer F*et al*who also observed the lowest mean blood glucose level during the first 3 hours of life.[10] Maximum 19 episodes of hypoglycemia were seen in first 24 hours (67.8%). As one of the preterm SGA baby had second episode during 48–72 hours of life.During second day (24–48 hours) 6 episodes of hypoglycemia were documented (21.4%). During 48–72 hours of life (3rd day) 4 episodes (14.2%) were documented.This declining trend is because infants counter–regulatory responses developed for hypoglycemia as age advances. Sexson WRalso found that incidence of hypoglycemia was more during first 12 hours of life i.e. 28.6% amongst babies who had risk factors for hypoglycemia.[11]Schafer–Graf UM*et al* also studied and found maximum incidence of hypoglycemia in first 24 hours of life.[12] We observed that maximum hypoglycemic babies were having septicemia (7/28) i.e. 25% followed by hyperbilirubinemiain (6/28) i.e. 18.75% and birth asphyxia in (5/32) i.e. 21.88% babies. Out of 32 babies, 6 were preterm AGA without any risk factor, except prematurity and birth weight. But still they comprised 18.75% of total hypoglycemic babies. Finding of our study are similar to the Singhal PK et al study in which amongst hypoglycemic babies, maximum were of septicemia and asphyxia group.[13] William AFhas also stated that neonates at risk of hypoglycemia includes those preterm and/or SGA, those who suffered from asphyxia or who are sick.[14] In conclusion, preterm babies are more prone to hypoglycemia and the episodes are maximum during first 0-24 hrs.Among all perinatal and postnatal stress factors, incidence of hypoglycemia is more common in septicemia and birth asphyxia which can be seen from first day to third day of life. Careful blood glucose level monitoring is required especially in preterm infants or those with risk factors.

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