Glucose Levels in Newborns with Special Reference to Hypoglycemia: A Study from Rural India

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ABSTRACT

Hypoglycemia is one of the common metabolic problems in neonatal medicine. There is association between blood glucose levels and neurological development. The study involved 100 mothers and neonates blood glucose levels were measured using a standard glucometer in mother delivering babies within half an hour of delivery and in newborns at 0, 3, 6, 12, 24 h of life. Blood glucose levels were low at 0th and 6th h and maximum at 24th h. Neonates born to mothers with high maternal blood glucose levels were hypoglycemic showing a negative correlation. The mean blood glucose levels were low in pre-term and post-term compared with term babies and range of blood glucose levels were wide in preterm and post term babies.

Key words:
Blood glucose levels, hypoglycemia, newborn, post-term, pre-term, term

INTRODUCTION

Glucose is essential for normal brain cell function. Normal blood glucose levels in the newborn period ensure proper neurological development.[4] Therefore early detection of hypoglycemia in infants at risk is of utmost value to prevent the sequelae arising from neonatal hypoglycemia.[2,3] Various factors influence newborn blood glucose concentrations even in healthy term newborns, such as birth weight, gestational age, presence or absence of disease, perinatal complications, mode of delivery and feeding behavior.[4,5]

Uncertainty exists with regard to optimal timing of blood glucose screening and intervals of glucose monitoring. Various studies in this regard has been conducted in urban setup but, detail conclusive data is lacking from semi urban setup in India. Hence the present study attempts to envisage, assessment of blood glucose levels in newborns and various factors influencing it with special reference to signs of hypoglycemia in semi urban set up. The results of this study may broaden our knowledge with regard to blood glucose assessment in semi urban setup.

MATERIALS AND METHODS

A hospital-based prospective study conducted in a rural hospital, after obtaining the institutional ethics committee approval. A total of 100 mothers and newborns irrespective of gestational age, weight, sex and mode of delivery were enrolled after taking informed consent. Sick infants with congenital and chromosomal anomalies were excluded. Babies were divided into different groups based on sex, mode of delivery and parity. Ballard’s score was calculated and they were divided into 4 groups based on the gestational age as 34-36 weeks, 36-38 weeks, 38-40 weeks and 40-42 weeks. They were divided into groups based on weight for gestational age based on charts from Seton medical center, Austin.[6]

After taking patients consent blood glucose levels were measured using a standard glucometer in mother delivering babies within half an hour of delivery and in newborns at 0, 3, 6, 12, 24 h of life. A note was made about the amount and type of intravenous (IV) fluid given to the mother. All the newborns were exclusively breastfed as per the hospital policy. In case the blood glucose levels were below 40 mg/dl (2.2 mmol/L) the signs of hypoglycemia were noted and the baby was treated with a trial of additional breastfeed or expressed breast milk and glucose levels were monitored.

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The data was analyzed using the SPSS (version 19 IBM). All the data was calculated applying descriptive statistics such as mean, percentage, Student’s t-test, ANOVA and Pearson correlation.

RESULTS

Of the 100 babies enrolled in the study, 58 were male and 42 were female. 49 babies were delivered vaginally and rest by caesarian section. 54 babies were born to primiparous mother and 46 to multiparous mother. 66 belonged to appropriate for gestational age (AGA) group, 17 to small for gestational age (SGA) and 17 to large for gestational age (LGA) group. 4 babies were born to diabetic mothers. Of the 100 babies, 5 were admitted to newborn intensive care unit and were on IV fluids. 4 babies were on nasogastric feeds and 91 babies were breast fed immediately after delivery. The blood glucose levels were low at 0 h. Then there was mild increase in the mean blood glucose levels at 3rd h followed by a minimal increase at 6th h and the maximum blood glucose levels were reached by 24th h [Figure 1].

Maternal blood glucose was measured within half an hour or at the time of delivery. All the mothers were on IV fluid, Ringer lactate 4 mothers were diabetic. Figure 2 shows correlation between the maternal and neonatal blood glucose level taken at birth. Figure 3 shows that pre-term and post-term babies were more prone for hypoglycemia compared to term babies. Variations in blood glucose levels are depicted in Table 1. The mean blood glucose levels were high in babies delivered vaginally, at all the time points compared to the babies delivered by lower segment caesarean section (LSCS). Nearly 19.6% of babies delivered by LSCS were hypoglycemic compared to 14.2% of the babies delivered vaginally.

Table 1: Variation in blood glucose levels in mmol/L at different time points based on weight for gestational age

| Blood glucose levels in mmol/L | N  | Mean    | Standard deviation | Minimum | Maximum |
|-------------------------------|----|---------|--------------------|---------|---------|
| 0 h                           | 66 | 2.9495  | 0.69483            | 1.72    | 5.11    |
| AGA                           | 17 | 3.2353  | 1.00318            | 1.78    | 4.89    |
| SGA                           | 17 | 2.6242  | 0.70424            | 1.50    | 3.78    |
| LGA                           | 17 | 3.4285  | 1.00463            | 1.83    | 7.78    |
| 3rd h                         | 66 | 3.3595  | 0.93234            | 1.89    | 5.39    |
| AGA                           | 17 | 3.3987  | 1.16803            | 1.78    | 6.61    |
| LGA                           | 17 | 3.3959  | 1.16803            | 1.78    | 6.61    |
| SGA                           | 17 | 3.7059  | 1.44775            | 2.44    | 7.11    |
| 6th h                         | 66 | 3.2609  | 1.09071            | 1.94    | 7.72    |
| AGA                           | 17 | 3.2386  | 0.72986            | 2.06    | 5.06    |
| SGA                           | 17 | 3.7059  | 1.44775            | 2.44    | 7.11    |
| LGA                           | 17 | 3.9444  | 1.31512            | 2.67    | 6.72    |
| 12th h                        | 66 | 3.5463  | 0.88507            | 2.11    | 7.56    |
| AGA                           | 17 | 3.6863  | 1.05225            | 2.67    | 7.11    |
| SGA                           | 17 | 3.9444  | 1.31512            | 2.67    | 6.72    |
| LGA                           | 17 | 3.7130  | 0.77113            | 1.67    | 6.11    |
| 24th h                        | 66 | 3.7941  | 0.54140            | 2.89    | 4.89    |

AGA = Appropriate for gestational age; SGA = Small for gestational age; LGA = Large for gestational age, \( n = 100 \)
Neonates with a blood glucose level $< 40$ mg/dl (2.2 mmol/L) at any time point were taken to be hypoglycemic. Of the 100, 17 babies were hypoglycemic at birth, though none of them showed signs of hypoglycemia. These babies were breastfed on demand. The blood glucose levels were monitored and at $3^{rd}$ h 11 babies were hypoglycemic and were started on IV fluids at 5 mg/kg/min. Of the 11, 7 babies were symptomatic. The glucose levels were continuously monitored. At $6^{th}$ h, 7 babies were hypoglycemic, of whom 6 were on IV fluids and 1 baby who was euglycemic until $6^{th}$ h and was being breastfed, had hypoglycemia. All the 6 babies who were on IV fluids resolved of hypoglycemia at $12^{th}$ h and 1 baby who was initially euglycemic till $6^{th}$ h, continued to have hypoglycemia at $12^{th}$ h even after expressed breast milk and additional breastfeeding. This baby was started on IV fluids at 5 mg/kg/min and glucose levels were monitored. Other 6 babies, who were initially hypoglycemic and became euglycemic at $12^{th}$ h, were slowly weaned of IV fluids and put on direct breastfeeding. The glucose levels normalized and all these babies were euglycemic by $24^{th}$ h. Only 1 baby who was initially euglycemic till $24^{th}$ h was hypoglycemic, which got resolved after giving expressed breast milk along with direct breastfeeding.

Of the 100 babies studied 4 babies were born to diabetic mother, of whom 3 were hypoglycemic at birth. One baby became euglycemic after a trial of additional breastfeed. The other 2 babies were put on IV fluids and glucose levels were normalized by $12^{th}$ h. Slowly they were weaned of IV fluids and put on direct breastfeeding.

**DISCUSSION**

Blood glucose levels were studied in 100 mothers and newborns irrespective of gestational age, weight for gestational age, sex and mode of delivery. There was a negative correlation between the maternal blood glucose taken within half an hour of delivery or at the time of delivery and neonatal blood glucose level taken at birth. This correlates with the study done by Singhi who found a negative correlation between the maternal blood glucose and neonatal blood glucose levels taken at birth. We noticed the babies of the mother, who had increased blood glucose levels, were found to be more prone for hypoglycemia as also observed by Curet et al.

Though the $P$ value was not significant, it was observed that there was influence of mode of delivery on the neonatal blood glucose levels. The mean blood glucose levels were high in babies delivered vaginally, at all the time points compared to the babies delivered by LSCS. The cesarean section involves less stress for the baby and the possible impact of perinatal anesthesia and shifting of mother from operation theatre may further delay breastfeeding and result in lower plasma glucose levels in babies delivered by LSCS compared to babies delivered vaginally as they are breastfed immediately or within half an hour after birth. And also the babies delivered vaginally undergo stress which releases catecholamines which in turn increases the blood glucose.

At birth the mean blood glucose levels were noted to be low in 34-36 weeks and 40-42 weeks neonates. However later at 3 h the mean blood glucose levels were high in 34-36 weeks neonates, but remained low in 40-42 weeks neonates. This correlates with the other studies where the pre-term babies had a lower mean blood glucose concentration in the first few postnatal hours compared with term babies. In contrast to Kayiran and Gürakan[11] we noticed glucose levels increased with the gestational age up to term and then decreased in post-term neonates. We suggest blood glucose monitoring for pre- and post-term neonates.

There was a wide variation in the occurrence of hypoglycemia. This can be correlated with study done in Iran where the incidence of hypoglycemia was 15.15%. We observed that pre-term and post-term babies were more prone for hypoglycemia when compared to term babies in contrast to a study done by Burdan et al.,[11] In this study, LGA babies were more prone for hypoglycemia followed by SGA neonates and AGA neonates at birth.

None of our babies showed signs of hypoglycemia at birth. The major signs noted were jitteriness, high cry, lethargy, tremors, limpness, apathy, weak cry and poor feeding, thus suggesting that there is a wide variation in signs associated with hypoglycemia.

**Recommendations**

All babies whose mothers have high blood glucose levels or babies having signs of hypoglycemia should be identified and monitored for blood glucose levels. Mothers should not be given excess of dextrose containing IV fluids and if given then neonates should be monitored for hypoglycemia. Blood glucose levels should be monitored in neonates delivered by LSCS, pre-term and post-term babies. SGA and LGA babies blood glucose levels also should be monitored.

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