

Follow up of blood glucose level in infants of diabetic mothers during the first 24 hours of life

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Abstract

Diabetes in pregnant woman, is a common medical complication which can lead to significant neonatal morbidities by causing infant hypoglycemia. The aim of this work is to study the neonatal hypoglycemia in IDMs in a tertiary care hospital. A cross-sectional study was done in postnatal ward in Al Qadisiyah Maternity and Children hospital from February to August 2020. All IDMs delivered during this period who admitted to postnatal ward were included in this study. The results were compared between the normoglycemic and hypoglycemic IDMs and also between gestational diabetic mothers (GDM) and pre-GDM in hypoglycemic group using Chi-square test and Fisher's exact test. The total number of IDMs who included in this study was 100 cases. Hypoglycemia occur in 74% of IDMs. 44% infants of GDM and 63% infants of pre-GDM developed hypoglycemia, i.e. it was more in infants of pre-GDM. Large for gestational age (LGA) were strongly associated with hypoglycemia ($P = 0.0001$, highly significant). 80.8% of hypoglycemic IDMs developed hypoglycemia during the first 6 h of age (P -value 0.00001, highly significant) and most of them (41.8%) developed it at 2 h of age. So that, early diagnosis and appropriate treatment for this critical problem are needed.

Keywords: Infants of diabetic mothers, hypoglycemia.

Introduction:

As the incidence of diabetes mellitus is increasingly rise and affects individuals of all ages including women of childbearing age, it became a common medical complication during pregnancy (prevalence 1-14%).⁽¹⁾ It may be pre-gestational (pre-GDM) or gestational diabetes mellitus (GDM).⁽²⁾

The aim of this study is to assess the blood glucose levels to observe frequency of hypoglycemia in IDMs in first 24 hours of life.

Because the glucose is essential for normal brain cell function and neurological development, rapid diagnosis and prompt management of patients with hypoglycemia is essential to avoid brain damage.⁽³⁾

In neonates, there is not always an obvious correlation between blood

glucose concentration and the classic clinical manifestations of hypoglycemia.⁽⁴⁾

The incidence of neonatal hypoglycemia is highest at 1–4 h after birth due to cessation of maternal glucose infusion.⁽⁵⁾

During pregnancy, maternal hyperglycemia increases glucose transport through the placental and results in fetal hyperglycemia, which stimulates fetal pancreatic insulin production. Maternal glucose supply ceases after delivery, while newborn insulin production continues resulting in neonatal hypoglycemia which may continue for 24–72 hours until insulin secretion returns to normal.⁽⁶⁾ Newborn glucose levels reach to nadir about the first 2 h of life and then increased and stabilize gradually.⁽⁷⁾

Because of concern for possible neurologic, intellectual, or psychological sequelae in later life, most authorities recommend that any value of blood glucose <55 mg/dL (3.1 mmol/L) in neonates be viewed with suspicion, investigated, and vigorously treated. This is particularly applicable after the initial 2-3 hour of life, when glucose normally has reached its nadir.⁽⁴⁾

Materials and Methods:

A cross-sectional study was done in Al Qadisiyah Maternity and Children hospital from February to August 2020.

Approval from Ethical Committee was obtained and written informed consent was taken from parents of the patients. Glucose level estimations were done at regular intervals.

Diabetic mothers were categorized into GDM and pre-GDM according to onset of diabetes mellitus and all infants who born to mothers with either GDM or pre-GDM staying in postnatal ward were included in this study. IDMs who suffer from respiratory distress, birth asphyxia, sepsis, very low birth weight, or congenital anomalies were excluded from the study.

For the study purpose, hypoglycemia was defined as blood sugar <55 mg/dL (3.1 mmol/L). Blood sugar was estimated

by glucometer at birth (0 hour) then every 2 hours for the first 24 h of life. All IDMs were fed by milk initially. Infants who developed hypoglycemia were managed by standard protocol.

Measurements of blood glucose were done by Bed-side On-Call Plus blood glucose meter, which is an rapid electrochemical enzymatic assay for glucose in capillary whole blood.

Statistical Analysis:

The outcomes were compared between the normoglycemic and hypoglycemic IDMs and between GDM and pre-GDM in hypoglycemic group using Chi-square test and Fisher's exact test.

Results:

The total number of IDMs were 100, 74 (74%) of them develop hypoglycemia.

In those infants who develop hypoglycemia, 80.8% of cases developed it within 6 hr of birth in (P -value = 0.00001 , highly significant). Most of cases of hypoglycemia are developed at 2 hr (31 cases), 4 hr (19 cases), and 6 hr (7 cases), while at 0 hr (3 cases), 8 hr (4 cases), 12 hr (6 cases), 18 hr (2 cases), and 24 hr (2 cases) of age. We note from these results that most of the IDM developed hypoglycemia at first 2–6 hr of age [Table 1].

Table 1: Percentage of cases who developed hypoglycemia according to age

Infant age (hours)	Number of cases who developed hypoglycemia	Percent from total number of cases with hypoglycemia
0	3	4 %
2	31	41.8 %
4	19	25.6 %
6	7	9.4 %
8	4	5.4 %
10	0	0%
12	6	8.1 %
14	0	0%
16	0	0%
18	2	2.7 %
20	0	0%
22	0	0%
24	2	2.7 %
Total number	74	100%

Discussion:

Maternal hyperglycemia can lead to fetal hyperglycemia which result in overstimulation of the fetal pancreatic islet cells leading to fetal hyperinsulinism. So, the IDMs are at significant risk for the development of hypoglycemia.⁽⁸⁾

Hypoglycemia occurs in IDMs with impaired gluconeogenesis due to excess insulin production, an inadequate substrate supply, decreased glucagon and catecholamine secretion, which mean an alteration in counter-regulatory hormone production.⁽⁹⁾

In this study, hypoglycemia developed in 38% of IDMs while hypoglycemia was observed in 25–48% in different studies.^(10,11)

Demographic characteristics of mother and IDMs were similar in normoglycemic and hypoglycemic groups except LGA [(12% in normoglycemic group vs 35% in hypoglycemic group, *P* value = 0.0001 , highly significant)], i.e. more in hypoglycemic group.

Hypoglycemia is more common in macrosomic IDMs than in IDMs who are of appropriate size for gestational age.⁽¹²⁾

Hypoglycemia in the macrosomic IDM firstly is caused by hyperinsulinemia secondary to pancreatic islet cell hyperplasia and secondly by removal of the exogenous (maternal) glucose source at the time of delivery.

During pregnancy, elevated maternal serum glucose results in elevated fetal serum glucose because insulin does not cross the placenta.⁽¹³⁾

According to this study, 44% infants of GDM and 63% infants of pre-GDM developed hypoglycemia, i.e. it was more in infants of pre-GDM. Many studies showed that hypoglycemia develops in approximately 25–50% of infants of mothers with pre-gestational diabetes and 15–25% of infants of mothers with gestational diabetes, which were similar to this study.⁽⁴⁾

Hypoglycemia was developed within the first 6 hours of life in 80.8% IDMs (*P*-value = 0.00001 , highly significant) and most of them (41.8%) were at first 2 hours of life. The nadir being reached in first 1–3 hours of life but recovery may begin within 4–6 hours.⁽¹⁴⁾

Neonatal hypoglycemia is associated with poor neurological outcome, so that, blood glucose level should be maintained ≥ 2.6 mmol/l (46.8 mg/dL) to ensure normal neural function in infants irrespective of the presence or absence of abnormal clinical signs.⁽¹⁵⁾

Conclusion:

Hypoglycemia is a common and serious problem in IDMs. A significant number of IDMs developed hypoglycemia in postnatal ward.

The majority of IDMs developed hypoglycemia within the first 6 hours of life and most were within 2 hours of life. LGA babies have been associated with hypoglycemia in IDMs.

The lower limit of accepted normality of the blood glucose level in newborn infants with associated illness that already impairs cerebral metabolism has not been determined. So that, early diagnosis and appropriate treatment for this critical problem are needed.

Conflicts of interest: There are no conflicts of interest.

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