Hypoglycemia in Infants Born to Diabetic Mothers – A Tertiary Care Hospital Experience

Saqib M.[1], Jameel S.A.[2], Arif U.[3], Anwar Z.[4], Waheed S.[5], Bashir M.[6] and Javed M.[7]
[1]*Department of Paediatric, Indus Health Care, Network, Lahore – Pakistan.*
[2]*Department of Paediatric, Indus Health Care, Children Hospital, Lahore – Pakistan.*
[3]*Department of Paediatric, Indus Health Care, Network, Lahore – Pakistan.*
[4]*Department of Obs. & Gynae., Dr. Sulaiman Alhabib Hospital, Alkhobar, Saudi Arabia.*
[5]*Department of Paediatric, Indus Health Care, Network, Lahore – Pakistan.*
[6]*Department of Paediatric, Indus Health Care, Network, Fatima Memorial Hospital, Lahore – Pakistan.*
[7]*Department of Pathology, University of Health Sciences, Lahore – Pakistan.*

ABSTRACT

Background and Objective: *Newborns from diabetic mothers, including diabetes type 1 & 2 and gestational diabetes, represent the group with the highest risk of developing symptomatic hypoglycemia in the immediate hours after birth. Neonatal hypoglycemia is a common metabolic abnormality in newborns due to inability to maintain glucose homeostasis. This study was designed to determine the glycemic levels in infants born to diabetic mothers at 2 hours of life before first feeding.*

Methods: *A total of 203 cases meeting inclusion criteria were recruitedfrom Nursery department of a local hospital of Lahore. After obtaining prior informed consent from parents or attendants, birth history like gestational age and their birth weight were noted from birth records of the baby. Blood sugar random (BSR) was measured in all neonates as per recommended criteria. All data was entered and analyzed using SPSS version 20.*

Results: *The mean age of neonates at the time of blood sugar monitoring was 68.86 ± 34.39 minutes, the mean gestational age was 38.25 ± 2.901 weeks and the mean birth weight was 2844.3 ± 605.0677 gm. According to operational definition, a total of 30 (14.8%) cases had hypoglycemia and 173 (85.2%) cases had normal BSR.*

Conclusion: *Hypoglycemia in neonates of diabetic mothers is a common complication which may be corrected by early breast-feeding or formula feeding.*

KEYWORDS: *Newborn, Maternal diabetes, Neonatal hypoglycemia.*

INTRODUCTION

Diabetes is one of the commonest and significant metabolic disorders that affect the health of pregnant women and infants. About 3 – 10% of all pregnancies are complicated by diabetes.[1,2] Diabetes before or during pregnancy is associated with increased risk to the mother and to the developing fetus.[1] Historically, infants born to mother with diabetes (IDM) have significantly greater risk for spontaneous abortion, stillbirth, congenital malformations and perinatal mortality and morbidity.[2] Increased mortality and morbidity are historically attributed to neonates of diabetic mothers. A discerning analysis of the literature shows that these adverse outcomes are uncommon among infants born from "pure" gestational diabetes mellitus (GDM) mothers, well managed during pregnancy.[3]

The incidence of GDM has increased over the last decades. This is due to the increase of obesity, maternal type 2 diabetes mellitus and advanced maternal age. GDM has a prevalence of 7.5%, and it is one of the metabolic disorders diagnosed in the mother that increase the risk of hypoglycemia in the newborns up to 27% compared to newborns of non-diabetic mother and, particularly, if the mother was not well-controlled during pregnancy.[4-6] Hypoglycemia is one of the most frequently encountered problems in the first 48 hours of life, and low glucose concentrations are perhaps the most common biochemical abnormality seen by providers caring for newborns.[7] Most reported complication of infants born to diabetic mothers is reported to be macrosomia 40.4% (n = 42) followed by hypoglycemia 23.8%.[6]

The rationale of this study is to find frequency of hypoglycemia in infants born to diabetic mothers in our population. Although there is national and international data amiable but there is wide range of frequency of hypoglycemia born to diabetic females i.e. 9.3% to 36%.[4,5,6,8]

Corresponding Author: Dr. Muhammad Saqib, Consultant Paediatrician
Indus Health Care, Network, Lahore -Pakistan.
Email: MuhammadSaqib199@gmail.com

METHODS

A total of 203 cases meeting inclusion criteria were recruited form Nursery department of Ittefaq Hospital (Trust), Lahore. After obtaining ethical approval from institute and a prior informed consent from parents or attendants, birth history like gestational age and their birth weight were noted from birth records of the baby. Hypoglycemia was measured in all neonates as per recommended criteria. Neonatal hypoglycemia was defined as a plasma glucose level of less than 30 mg/ dL (1.65 mmol/L) in the first 24 hours of life and less than 45 mg/dL (2.5 mmol/L).[9] All collected data was entered on prescribed proformas.

Table-1: *Relationship of Different Variables with Hypoglycemia.*

Variables		*No. of Subjects*	*Hypoglycemia*		*P-Value*
			Yes (%)	*No (%)*	
Age	1-60 min	79	12 (40.0%)	67 (38.7%)	0.895
	>60 min	124	18 (60.0%)	106 (61.3%)	
Gender	Male	135	20 (66.7%)	115 (66.5%)	0.984
	Female	68	10 (33.3%)	58 (33.5%)	
Gestational age (weeks)	Pre-term birth	27	2 (6.7%)	25 (14.5%)	0.246
	Full term birth	176	28 (93.3%)	148 (85.5%)	
Weight (g)	< 2500g	58	9 (30%)	49 (28.3%)	0.851
	≥ 2500g	145	21 (70.0%)	124 (71.7%)	

STATISTICAL ANALYSIS

All data was entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 24. Mean ± S.D was used for quantitative data like age, birth weight, gestational age (week). Qualitative data like gender and hypoglycemia was given in form of frequency (%). Data was stratified for age, gender, gestational age and birth weight to address effect modifiers. Post stratification Chi-square test was applied considering P-value ≤ 0.05 as significant.

RESULTS

The mean age of neonates was 68.86 ± 34.39 minutes with minimum and maximum age as 02 and 120 minutes. There were 79 (38.9%) cases whose age was 1-60 minutes and 124 (61.1%) cases were 61-120 minutes old.

There were 135 (66.5%) male and 68 (33.5%) female cases. A total of 27 (13.3%) cases were preterm birth and 176 (86.7%) were full term. The mean birth weight was 2844.3 ± 605.0677g with minimum and maxi-mum weight being 1805.0 and 4030.0 g respectively.

According to operational definition, a total of 30 (14.8%) cases had hypoglycemia and 173 (85.2%) cases had normal BSR.

When data was stratified for age, gender, gestational age and birth weight, it was observed that frequency of hypoglycemia was statically same in all strata compared to non-hypoglycemic group, *P-value > 0.05* (Table-1).

DISCUSSION

Gestational diabetes mellitus (GDM), defined as carbohydrate intolerance with the onset or first recognition during pregnancy, affects an estimated 2–10% of pregnancies. Prevalence of GDM varies by race–ethnicity, ranging from a low of 6.8% among non-Hispanic whites to 16.3% among Asians and Pacific Islanders. Gestational diabetes mellitus is associated with increased risk of fetal macrosomia, large-for-gestational-age neonates, preeclampsia, perinatal mortality, and cesarean delivery as well as long-term hazards, including a higher risk of maternal type 2 diabetes and obesity, glucose intolerance, and metabolic syndrome in the off-spring of women born to mothers diagnosed with GDM.[8-11] The Neonatal mortality rate is over five times that of infants of non-diabetic mothers & is higher at all gestational ages & in every birth weight for gestational age category. Pregnant women with underlying insulin resistance may have difficulty producing enough insulin to lower blood glucose to safe levels, and exercise-induced improvements in cellular glucose uptake and insulin production thereby help prevent the excessive blood glucose levels associated with GDM.[1,10] Studies have indicated that the magnitude of risk of maloccurences is proportional to the level of maternal hyperglycemia. Therefore to some extent, the excessive fetal & neonatal morbidity of diabetes in pregnancy is preventable or at least reducible through meticulous prenatal & intrapartum care.[11-14]

A study conducted by Dim et al.[15] reported that effective treatment of GDM has been shown not only to reduce perinatal morbidity but also to likely improve the woman's quality of life. Evidence abounds that it may be better to measure postprandial than pre-prandial levels because postprandial glycemic levels

are better correlated with certain adverse outcomes such as congenital malformations, macrosomia, hypoglycemia and shoulder dystocia.[15]

Despite the regulation of maternal glucose levels, clinicians observe an excess of large-for-gestational-age (LGA) newborns and neonatal complications among GDM women. A study conducted by Barquiel et al.[16] reported that average third-trimester HbA1c level ≥ 5% and gestational weight gain above the IOM recommendation are relevant risk factors for neonatal complications in mothers with gestational diabetes. In this study 1319 women were included, out of which 7.3% versus 3.8% (P= 0.005) neonates were of large-for-gestational-age and 22.0% versus 16.0% (P= 0.006*)* of the neonates with complications.[16]

According to another study conducted by Thomas et al.[4] out of the 10,394 mothers who delivered during this study period**,** 574 (5.5%) were diagnosed to have gestational diabetes. 137 were treated with insulin and 141 with oral hypoglycemic agents. 44 (15.8%) babies were born preterm, 97 (35%) were large for gestational age, 13 (4.7%) were small for gestational age and 9 (3.2%) were macrosomic. Hypoglycemia was seen in 26 (9.3%) babies, congenital anomalies in 15 (5.4%) and birth injuries in 7 (2.5%).[4] In the current study a total of 27 (13.3%) cases were preterm birth and 176 (86.7%) were full term. Hypoglycemia was seen in 30 (14.8%) cases. There were 58 (28.6%) cases having weight < 2500g and 145 (71.4%) cases having weight ≥ 2500gm.

A prospective cohort study was conducted by Flores-le Roux et al.[5] to analyze first-day-of-life glucose levels in infants of women with gestational diabetes and the influence of maternal, gestational and peripartum factors on the development of neonatal hypoglycemia. Out of 190 infants, 23 (12.1%) presented mild, 20 (10.5%) moderate and only 5 (2.6%) severe hypoglycaemia.[5] Hypoglycemic infants were more frequently large-for-gestational-age (29.3% vs. 11.3%, *P= 0.003*), had lower umbilical cord pH (7.28 vs 7.31, *P= 0.03*) and their mothers had more frequently been hyperglycaemic during labour (18.8% vs. 8.5%, *P= 0.04*). Similar findings have been reported by other studies.[5,17,18]

CONCLUSION

Hypoglycemia in neonates of diabetic mothers is a common complication among infants of diabetic mothers. Neonatal hypoglycemia should always be anticipated and screened for in high-risk patients, even in the absence of clinical symptoms, from the first moments of post-natal life to avoid short and long term complications in neonates. Subsequent management may be made timely and rigorously.

LIMITATIONS OF STUDY

This study may be supplemented with possible future larger scale surveys in order to strengthen the conclusions drawn about study topic under discussion.

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AUTHOR'S CONTRIBUTION

MS: Conception of study, acquisition of data, final approval of the version to be published.
SAJ: Conception of study, acquisition of data.
UA: Analysis and interpretation of data, revising it critically for important intellectual content.
ZA: Acquisition of data.
SW: Drafting the article.
MB: Acquisition of data.
MJ: Acquisition of data, final approval of article.

CONFLICT OF INTEREST

None to declare.

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None to disclose.

REFERENCES

1. Sultana N, Shermin S, Naher N, Ferdous F. Diabetes in pregnancy: maternal profile and neonatal outcome. Delta Med Coll J. 2016; 4 (2): 83-8.
2. Cordero L, Oza-Frank R, Moore-Clingenpeel M, Landon M, et al. Failure to initiate breastfeeding among high risk obstetrical patients who intended to breastfeed. J Neonatal-perinatal Med. 2016; 9 (4): 401-9.
3. Mitanchez D, Yzydorczyk C, Simeoni U. What neonatal complications should the pediatrician be aware of in case of maternal gestational diabetes? World J Diabetes, 2015; 6 (5): 734-43.
4. Thomas N, Chinta AJ, Sridhar S, Kumar M, et al. Perinatal outcome of infants born to diabetic mothers in a developing country-comparison of insulin and oral hypoglycemic agents. Ind Pediatr. 2013; 50 (3): 289-93.
5. Flores-le Roux JA, Sagarra E, Benaiges D, Hernandez-Rivas E, et al. A prospective evaluation of neonatal hypoglycaemia in infants of women with gestational diabetes mellitus. Diabetes Res Clin Pr. 2012; 97 (2): 217-22.
6. Alemu BT, Baydoun HA, Akpinar-Elci M, Hoch M, et al. Neonatal hypoglycemia in diabetic mothers: A systematic review. Curr Pediatr Res. 2017: 21 (1): 42-53.
7. Rozance PJ. Update on neonatal hypoglycemia. Curr Opin Endocrinol Diabetes Obes. 2014; 21 (1): 45-9.
8. Cordero L, Paetow P, Landon MB, Nankervis CA, et al. Neonatal outcomes of macrosomic infants of diabetic and non-diabetic mothers. J Neonatal Perinatal Med. 2015; 8 (2): 105-12.

9. Ogunyemi D, Friedman P, Betcher K, Whitten A et al. Obstetrical correlates and perinatal consequences of neonatal hypoglycemia in term infants. J Matern Fetal Neonatal Med. 2017; 30(11): 1372-7.
10. Rosenberg VA, Eglinton GS, Rauch ER, Skupski DW, et al. Intrapartum maternal glycemic control in women with insulin requiring diabetes: a randomized clinical trial of rotating fluids versus insulin drip. Am J Obstet Gynecol. 2006; 195 (4): 1095-9.
11. HAPO Study Cooperative Research Group, Metzger BE, Lowe LP, Dyer AR, et al. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med. 2008; 358(19): 1991-2002.
12. Landon MB, Rice MM, Varner MW, Casey BM, et al. Mild gestational diabetes mellitus and long-term child health. Diabetes Care. 2015; 38 (3): 445-52.
13. Russo LM, Nobles C, Ertel KA, Chasan-Taber L, et al. Physical activity interventions in pregnancy and risk of gestational diabetes mellitus: a systematic review and meta-analysis. Obstet Gynecol. 2015; 125 (3): 576-82.
14. Frise CJ, Williamson C. Endocrine disease in pregnancy. Clin Med. 2013; 13 (2): 176-81.
15. Dim C, Okafor C, Ikeme A, Anyahie B. Diabetes mellitus in pregnancy: an update on the current classification and management. Niger J Med. 2012; 21 (4): 371-6.
16. Barquiel B, Herranz L, Hillman N, Burgos MA, et al. HbA1c and gestational weight gain are factors that influence neonatal outcome in mothers with gestational diabetes. J Women's Health. 2016; 25 (6): 579-85.
17. Rozance PJ, Hay WW. New approaches to management of neonatal hypoglycemia. Matern Health Neonatol and Perinatol. 2016; 2 (1): 3-11.
18. Ramos GA, Hanley AA, Aguayo J, Warshak CR, et al. Neonatal chemical hypoglycemia in newborns from pregnancies complicated by type 2 and gestational diabetes mellitus–the importance of neonatal ponderal index. Matern Fetal & Neonatal Med. 2012; 25 (3): 267-71.

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