Original Article

Diabetes in Pregnancy: Maternal Profile and Neonatal Outcome

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Abstract

Background: *Diabetes in pregnancy is associated with increased risk to the woman and to the developing fetus. Historically, infants born to mother with diabetes (IDM) have significantly greater risk for spontaneous abortion, stillbirth, congenital malformations and perinatal mortality and morbidity.* ***Objective:*** *To evaluate the complications associated with diabetes in pregnancy in the periconceptional, fetal, neonatal and postnatal period.* ***Materials and method:*** *This observational study was carried out in the department of Obstetrics & Gynaecology of Bangladesh Institute of Research & Rehabilitation in Diabetes, Endocrine & Metabolic Disorders (BIRDEM), Dhaka, Bangladesh, from July 2013 to December 2013. Data of 100 patients with pregestational diabetes mellitus (PGDM) and gestational diabetes mellitus (GDM) delivering live baby after 37 completed weeks were evaluated during the period. They were divided into two groups: patients with PGDM in group-A and patients with GDM in group-B.* ***Results:*** *Majority of the PGDM patients were in 31-35 years age group whereas 50% of the GDM patients were from younger group (26-30). A major proportion of the patients of both the groups required Caesarean section with a higher rate in group-A. Diabetic mothers had more macrosomic babies than GDM mothers (14% vs 4%). Most commonly found neonatal complications were hyperbilirubinaemia followed by RDS and hypoglycaemia in both the groups with a higher proportion in PGDM group.* ***Conclusion:*** *Almost similar maternal and neonatal complications were observed in both PGDM and GDM group in our study despite of integrated antenatal, intranatal and perinatal care with a higher proportion in PGDM patients.*

Keywords: *Pregestational diabetes mellitus; gestational diabetes mellitus; neonatal outcome.*

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Introduction

Diabetes is the most common endocrine disorder complicating pregnancy. Incidence of both type-I and type-II diabetes is increasing throughout the world. As the incidence of diabetes continues to rise and increasingly affects individuals of all age including young adults and children, women of childbearing age are at increased risk of diabetes during pregnancy.[1]

Diabetes may manifest itself for the first time in pregnancy i.e. gestational diabetes mellitus

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(GDM) or a diabetic woman may become pregnant i.e. pregestational diabetes mellitus (PGDM). World Health Organization (WHO) defined gestational diabetes mellitus as 'Carbohydrate intolerance resulting in hyperglycaemia of variable severity with onset or first recognized during pregnancy'.[2]

There has been a marked increase in the prevalence of diabetes in Asia over recent years. Diabetes complicating pregnancy, in particular gestational diabetes, has also increased markedly in the region.[3] It is estimated to affect approximately 16.9% of pregnancies globally, with the highest prevalence in South-East Asia, where an estimated 25% of pregnancies are affected.[4]

Diabetes in pregnancy is associated with increased risk to the woman and to the developing fetus.[5] Gestational diabetes mellitus also increases the likelihood of subsequent diabetes in the mother in high risk women and the risk of recurrence in future pregnancies has been reported to be as high as 68%.[6]

Historically, Infants of diabetic mothers (IDMs) have significantly greater risk for spontaneous abortion, stillbirth, congenital malformations and perinatal mortality and morbidity.[7] Their morbidity and mortality rates have decreased nearly 30-fold since the development of specialized maternal, fetal, and neonatal care for women with diabetes and their offspring over the past three decades. Before then, fetal and neonatal mortality rates were as high as 65%.[8] Advances in maternal and fetal care have improved the outlook of the IDM to the point at which most pregnant women with diabetes can expect to deliver a healthy child when they have received appropriate prenatal care.[7]

Currently 3-10% pregnancies are complicated by abnormal glycaemic control. Of these, 80-88% are caused by gestational diabetes mellitus as opposed to pregestational diabetes mellitusand 65% of these mothers have been found to have type 2 diabetes mellitus.[7,8] This number may rise significantly in the next decade as the current significantly overweight paediatric population head into their childbearing years.[7]

The IDM is at increased risk for periconceptional fetal, neonatal and long-term morbidities. The cause of the fetal and neonatal sequelae of maternal diabetes are likely to be multifactorial, however, many of the perinatal complications can be traced to the effect of maternal glycaemic control on the fetus and can be prevented by appropriate preconceptional and prenatal care.[9]

Most of the fetal and neonatal complications of diabetes during pregnancy are due to maternal hyperglycaemia. The concept had its own ontogeny in the Pedersen hypothesis which states that maternal hyperglycaemia results in fetal hyperglycaemia because glucose readily traverses the placenta. Before 20 weeks of gestation, the fetal islet cells are not capable of responsive insulin secretion, and the main pathogenic condition to which the embryo and early fetus are subjected is hyperglycaemia. Thereafter the fetus has a functioning pancreas and is responsible for its own glucose homeostasis. Unchecked fetal hyperglycaemia results in hypertrophy of fetal pancreas and hyperinsulinaemia. The pathogenic conditions in the late gestation fetus and IDM are the result of fetal hyperglycaemia, hyperinsulinaemia or the combined effects of the two.[7]

This article focuses on the complications associated with diabetes in pregnancy, both PGDM and GDM, as they occur in the periconceptional, fetal, neonatal and postnatal time period.

Materials and method

This cross sectional observational study was done in the department of Obstetrics & Gynaecology, Bangladesh Institute of Research &

Rehabilitation in Diabetes, Endocrine & Metabolic Disorders (BIRDEM), Dhaka, Bangladesh during the period of July 2013 to December 2013. Purposive sampling was done at the time of delivery and data were collected. The inclusion criteria were live fetus of diabetic mother (both PGDM and GDM) delivered after 37 completed weeks. Data of 100 patients were evaluated during the period. They were divided into two groups: patients with PGDM in group-A and patients with GDM were in group-B. Patients on nutrition therapy, multiple pregnancy and those with other co morbidities (e.g. chronic hypertension, preeclampsia, endocrine disorders affecting fetal outcome, etc.) were excluded. Verbal consent was taken from all the participants. Confidentiality was maintained.

Results

A total of 100 pregnant patients were evaluated. Fifty patients had pregestational diabetes mellitus (group-A) and fifty had GDM (group-B). Majority of the PGDM patients were in 31-35 years age group whereas 50% of the GDM patients were from younger group (26-30). Most of the patients were multipara in both the groups.The patients were mostly on regular antenatal checkup. Majority of the patients of both the groups required termination by Caesarean section with a higher rate in group-A (Table I).

Table I: Maternal profile

	Group-A (n=50) Frequency (%)	Group-B (n=50) Frequency (%)
Age group (years)		
<25	7 (14%)	6 (12%)
26-30	13 (26%)	25 (50%)
31-35	20 (40%)	16 (32%)
> 35	10 (20%)	3 (6%)
Parity		
Primipara	9 (18%)	13 (26%)
Multipara	41 (82)	37 (74%)
Antenatal check up		
Regular	42 (84%)	45 (90%)
Irregular	8 (16%)	5 (10%)
Mode of delivery		
Normal vaginal delivery	8 (16%)	16 (32%)
Caesarean section	42 (84%)	34 (68%)

Caesarean section was required more in group-A and was influenced by several factors like previous history of C-section, bad obstetric history, fetal macrosomia and others (Table II).

Table II: Indication of Caesarean section

Indications	Group-A (n=42) Frequency (%)	Group-B (n=34) Frequency (%)
History of previous Caesarean section	16 (45.2%)	12 (35.2%)
Failed induction	13 (30.9%)	13 (38.2%)
Bad obstetric history	3 (7.1%)	1 (2.9%)
Malpresentation	3 (7.1%)	4 (11.7%)
Fetal distress	4 (9.5%)	3 (8.8%)
Premature rupture of membrane	3 (7.1%)	1 (2.9%)

Neonatal outcome was evaluated just after delivery and is presented in Table III.

Table III: Neonatal profile including complications

Indications	Group-A (n=42) Frequency (%)	Group-B (n=34) Frequency (%)
Birth weight		
Low birth weight	5 (10%)	1 (2%)
Appropriate for gestational age	38 (76%)	47 (94%)
Macrosomia	7 (14%)	2 (4%)
APGAR score (at 5 minute)		
Severely depressed (0-3)	1 (2%)	0
Moderately depressed (4-6)	27 (54%)	18 (36%)
Excellent condition (7-10)	22 (44%)	32 (64%)
Presence of complication		
Yes	40 (80%)	35 (70%)
No	10 (20%)	15 (30%)
Complications*		
Respiratory distress syndrome	28 (56%)	20 (40%)
Hyperbilirubinaemia	36(72%)	30 (60%)
Hypoglycaemia	10 (20%)	6 (12%)
Hypocalcaemia	1 (2%)	2 (4%)
Congenital anomaly	2 (4%)	0
Macrosomia	3 (6%)	1 (2%)
Fetal growth retardation	5 (10%)	0

* Multiple responses

Discussion

Strict maternal glycaemic control during a pregnancy complicated by diabetes mellitus reduces neonatal mortality and morbidity. Fetal hyperinsulinaemia and its associated metabolic abnormalities can be reduced by tight glycaemic control after 28 weeks of gestation. Similarly fetal macrosomia can be prevented by appropriate glycaemic control from 32 weeeks of gestation until term.[7]

Good glycaemic control by medical nutrition therapy and insulin, when required, along with proper antenatal check up can make up diabetic and GDM pregnancies as safe as non diabetic pregnancies. Though several studies showed that good glycaemic control reduces neonatal complications,[10-12] still PGDM and GDM are associated with adverse fetal and maternal outcomes even after adequate antenatal care and glycaemic control.[12,13] Adverse fetal outcomes include congenital anomalies, trauma during birth, macrosomia, and perinatal morbidity and mortality.[14,15] Adverse maternal outcomes include increased rates of caesarean section and increased lifetime risk of developing type 2 diabetes.[15,16]

Regarding analysis of the demographic characteristics, in our study group majority (40%) of the PGDM patients were in 31-35 years age group whereas 50% of the GDM patients were from younger group (26-30). This observation is in line with previous studies.[17-21] Mothers with PGDM had higher parity compared to the GDM group like in previous studies.[18-21]

Majority of the patients of both our study groups required termination by Caesarean section with a higher rate in PGDM group which was influenced by several factors like previous history of C-section, bad obstetric history, fetal macrosomia and others. In a study by Fong et al.[21] subjects with PGDM were more likely than those with GDM to have a shoulder dystocia, failed induction of labor, or undergo Caesarean delivery. These observations are also supported by other studies.[15-17]

Our results confirmed the findings of other investigators about the worse perinatal and maternal outcomes of pregnancies complicated by PGDM compared with the outcomes of pregnancies complicated by GDM.[18-20] Some other studies also concluded that fetal outcome in women with GDM seemed to be better than women known to be diabetic despite insulin control.[22-24]

Neonatal outcome in both groups were evaluated. Majority of the neonates were of appropriate birth weight but diabetic mothers had more macrosomic babies than GDM mothers (14% vs 4%). In a study by Wahabi et al.[20] the neonates of the mothers with PGDM were significantly heavier when compared to those of GDM group and the frequency of macrosomia was more than threefold among PGDM group compared to GDM group which is almost similar to the finding of this study. Many factors might have influenced the difference in the outcomes between these two groups such as the prolonged exposure of the fetus to maternal hyperglycemia in the case of PGDM with the resultant prolonged fetal hyperinsulinaemia and increased C-peptide level and thus more severe effect on fetal weight gain, macrosomia and the related complications such as increased number of Caesarean delivery.[13,25] Still the rate of macrosomia in both of our study groups were much lower than those of several other centres where the rate was about 36-42%.[26-28] The hospital where this study was conducted is a major referral centre for women with GDM and also pregnancy with DM. The management of pregnant diabetic women is part of the routine obstetric practice in this tertiary health care centre, and there is also an established protocol for antenatal, perinatal and postnatal management of diabetic pregnant women and their infants. And these facts might explain the lower rate of macrosomia observed in this study as compared to the published literature.

We found relatively good APGAR score in neonates of GDM group than PGDM. Niliet al.[17] and Rackham et al.[29] also got similar findings. Most commonly found neonatal complications were hyperbilirubinaemia followed by RDS and hypoglycaemia in both the groups with a higher proportion in PGDM group. This is consistent with the findings of Niliet al.[17] though frequency was variable.

Diabetes in pregnancy either in the form of PGDM or GDM impose a number of maternal and neonatal morbidities. Almost similar maternal and neonatal complications were observed in both PGDM and GDM group in our study despite of integrated antenatal, intranatal and perinatal care with a higher proportion in PGDM patients. This message must be kept in mind while managing such pregnancies.

References

1. Hunt KJ, Schuller KL. The Increasing Prevalence of Diabetes in Pregnancy. Obstet Gynecol Clin N Am. 2007;34(2):173-99.
2. Part 1: Diagnosis and Classification of Diabetes Mellitus. Definition, Diagnosis and Classification of Diabetes Mellitus and Its Complication. World Health Organization and Department of Non-communicable Disease Surveillance, Geneva; 1999. Report of WHO Consultation.
3. Tutino GE, Tam WH, Yang X, Chan JCN, Lao TTH, Ma RCW. Diabetes and Pregnancy: Perspectives from Asia. Diabet Med. 2014;31(3):302-18.
4. International Diabetes Federation. Diabetes Atlas. 6th ed. Brussels, Belgium: International Diabetes Federation, 2013 [cited 2015 Dec 5]. Available from: http:// www.idf.org/diabetesatlas.
5. Casson IF. Outcomes of Pregnancy in Insulin Dependent Diabetic Women: Result of a 5 Year Population Cohort Study. BMJ. 1997;315(7103):275-78.
6. Spong CY, Guillermo L, Kuboshige J, Cabalum T. Recurrance of GDM: Identification of Risk Factors. Am J perinatal. 1998;15(1);29-33.
7. Nold JL, Georgieff MK. Infants of Diabetic Mothers. Pediatr Clin N Am. 2004;51:619-37.
8. Potter CF, Kicklighter SD. Infant of Diabetic Mother [Internet]. 2016 Jan 8 [cited 2016 Feb 25]. Available from: http://emedicine.medscape.com/article/974230-overview.
9. Widness JA. Fetal Risk and Neonatal Complication of Diabetes Mellitus and Metabolic and Endocrine Disorder. In: Brody SA, Ueland K, editors. Endocrine Disorders in Pregnancy. Nor-Walk (CT): Appleton-Lange; 1989. p.273-93.
10. Xiong X, Saunders LU, Wang FL, Demianczuk NM. Gestational Diabetes Mellitus: Prevalence, Risk factors, Maternal and Fetal Outcomes. Int J Gynocol Obstet. 2001;75(3);221-28.
11. Jesen DM, Sorensen B, Jorgensen NF, Westergaard JG, Nielsen HB. Maternal and Perinatal Outcomes in 143 Danish Women with GDM and 143 Controls with a Similar Risk Profile. Diabet Med. 2001;17(4):281-86.
12. Crowther CA, Hiller JE, Moss JR, Mcphee AJ, Jeffries WS, Robinson JS. Effect of Treatment of GDM on Pregnancy Outcomes. N Engl J Med. 2005;352;2477-86.
13. HAPO Study Cooperative Research Group, Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, Coustan DR, et al. Hyperglycemia and Adverse Pregnancy Outcomes. N Engl J Med. 2008;358:1991-2002.
14. Thorpe LE, Berger D, Ellis JA, Bettegowda VR, Brown G, Matte T, et al. Trends and Racial/Ethnic Disparities in Gestational Diabetes among Pregnant Women in New York City, 1990-2001. American Journal of Public Health. 2005;95(9):1536-39.
15. Rosenberg TJ, Garbers S, Lipkind H, Chiasson MA. Maternal Obesity and Diabetes as Risk Factors for Adverse Pregnancy Outcomes: Differences among 4 Racial/Ethnic Groups. American Journal of Public Health. 2005;95(9):1545-51.
16. Langer O, Yogev Y, Most O, Xenakis EMJ. Gestational Diabetes: The Consequences of Not Treating. Am J Obstet Gynecol. 2005; 192(4);989-97.
17. Nili F, Mahdaviani A. Comparison of Morbidities between Infants of Pregestational & Gestational Diabetic Mothers. MJIRI. 2004;18(1):13-19.
18. Barakat MN, Youssef RM, Al-Lawati JA. Pregnancy Outcomes of Diabetic Women: Charting Oman's Progress towards the Goals of the Saint Vincent Declaration. Ann Saudi Med. 2010;30:265-70.

19. El Mallah KO, Narchi H, Kulaylat NA, Shaban MS. Gestational and Pre-gestational Diabetes: Comparison of Maternal and Fetal Characteristics and Outcome. Int J Gynaecol Obstet. 1997;58(2):203-209.

20. Wahabi HA, Fayed A, Esmaeil SA. Maternal and Perinatal Outcomes of Pregnancies Complicated with Pre-gestational and Gestational Diabetes Mellitus in Saudi Arabia. J Diabetes Metab. 2014;5:399. doi:10.4172/2155-6156.1000399.

21. Fong A, Serra A, Herrero T, Pan D, Ogunyemi D. Pre-Gestational Versus Gestational Diabetes: A Population Based Study on Clinical and Demographic Differences. J Diabetes Complications. 2014;28(1):10.

22. Shand AW, Bell JC, McElduff A, Morris J, Roberts CL. Outcomes of Pregnancies in Women with Pre-Gestational Diabetes Mellitus and Gestational Diabetes Mellitus; a Population-Based Study in New South Wales, Australia, 1998-2002. Diabet Med. 2008;25:708-15.

23. Ray JG, Vermeulen MJ, Shapiro JL, Kenshole AB. Maternal and Neonatal Outcomes in Pregestational and Gestational Diabetes Mellitus, and the Influence of Maternal Obesity and Weight Gain: the DEPOSIT Study. Diabetes Endocrine Pregnancy Outcome Study in Toronto. QJM. 2001;94:347-56.

24. Kasm MA. Fetal Outcome of Diabetic Mothers: A Comparison between Gestational Diabetes vs Prenatally Diagnosed Diabetic Women. Med J Cairo Univ. 2012;80(2):225-27.

25. Nachum Z, Ben-Shlomo I, Weiner E, Shalev E. Twice Daily Versus Four Times Daily Insulin Dose Regimens for Diabetes in Pregnancy: Randomised Controlled Trial. BMJ. 1999;319:1223-27.

26. Farooq MU, Ayaz A, Ali BL, Ahmed I. Maternal and Neonatal Outcomes in Gestational Diabetes Mellitus. International Journal of Endocrinology and Metabolism. 2007;5(3):109-15.

27. Hussain M, Irshad M, Khattak AK, Khan B. Frequency of Various Neonatal Complications in Infants Born to Diabetic Mothers - a Hospital Base Study. Journal of Postgraduate Medical Institute (Peshawar - Pakistan). 2011;25(3):227-32.

28. Haider G, Zehra N, Anjum F, Munir AA. Perinatal Outcome in Diabetic Mothers at Isra University Hospital. Isra Medical Journal. 2009;1(1):8-12.

29. Rackham O, Paize F, Weindling AM. Cause of Death in Infants of Women with Pregestational Diabetes Mellitus and the Relationship with Glycemic Control. Postgrad Med. 2009;121:26-32.