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ORIGINAL ARTICLE

Factors Associated with Gestational Diabetes Mellitus and Its Outcome in Pregnancy

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ABSTRACT

Background: Gestational diabetes mellitus is prevailing among pregnant females and affects the pregnancy outcome both in neonate and mother. As Pakistan is having high incidence of diabetes mellitus so females are at high risk of developing gestational diabetes mellitus (GDM). Other factors that may lead to GDM include age of female, weight, family history, previous history or family history of diabetes, stillbirths, previous history of large gestation and other socio-demographic factors. Whatever the risk factors are, the outcome of pregnancy in females with gestational diabetes is related to increased cesarean section, hyperglycemia and hypertension in mothers. Hypoglycemia is just after birth, macrosomia and large gestation in neonates. In order to determine risk factors and association of GDM with pregnancy outcome we have conducted this study with future implications for better pregnancy outcome.

Methodology: An analytical study was conducted at the department of Gynae & Obs, Al-Nafees Medical College and Hospital, Islamabad for a period of one year and 9 months starting from July 2019 to March 2021. All the pregnant females diagnosed with gestational diabetes during their checkup in hospital visits were included in study through convenient sampling. The socio-demographic and laboratory data was obtained from their file record and pregnancy outcome was observed at the time of delivery in the same hospital. The analysis was done for 150 females by using SPSS version 26. Continuous variables were analyzed by mean and standard deviation while categorical variables were determined by frequencies in percentage. Outcome of pregnancy was analyzed by macrosomia, hypoglycemia in neonates and cesarean, hypertension in mothers. The association was determined between GDM and pregnancy outcome by chi-square test of significance where $p < 0.05$.

Results: In our study 150 females were of mean age 33.91 with ±3.72 SD. The mean self-reported, pre-pregnancy BMI(Kg/m^2) of all pregnant females was 29.89 with ±4.55 SD. The mean number of children born to females was 3.4. There is no significant association of gestational period with neonatal or maternal death p- value was 0.308 and 0.410 respectively by applying chi-square test ($p<0.05$). The gestational diabetes mellitus is associated with cesarean section as 78(52%) females underwent elective c-section. Among these females 84(56%) developed hypertension and 18(21%) were managed for eclampsia. Neonates born with macrosomia were 48 (32%) and with hypoglycemia just after birth were 89 (59.3%).

Keywords: Gestational diabetes mellitus (GDM), Outcome of pregnancy, Macrosomia, Neonatal hypoglycemia, Maternal hypertension.

INTRODUCTION

Gestational diabetes is referred to as the impaired glucose level during pregnancy. According to the World Health Organization (WHO) the pregnant woman is said to have gestational diabetes mellitus (GDM) at any time during pregnancy if one or more of the following criteria are met. Fasting plasma glucose 5.1-6.9 mmol/l (92 -125 mg/dl), 2. one-hour plasma glucose ≥ 10.0 mmol/l (180 mg/dl) following a 75g oral glucose load. 3. two-hour plasma glucose 8.5-11.0 mmol/l (153 -199 mg/dl) following a 75g oral glucose load.(1) Gestational diabetes mellitus (GDM) is defined as a glucose tolerance disorder with onset during pregnancy and is associated with increased neonate-maternal morbidity as well as long-term complications in mother and child. Women who fulfil the criteria of fasting plasma glucose >126mg/dl, spontaneous glucose level >200mg/dl or HbA1c> 6.5% before 20 weeks of gestation, should be classified as having GDM. Early screening for type 2 diabetes at the first booking prenatal visit is particularly advised in women at increased risk with history of GDM or prediabetes, stillbirth, previous abortions or neonate birth weight >4500g in previous pregnancies, obesity, age >35 years, cardiac disease, clinical symptoms of diabetes with increased risk for GDM/T2DM.(2)

The prevalence rate of gestational diabetes is more among Asian population. This might be due to genetic predisposition and high prevalence of family history of diabetes mellitus.(3) Pakistan ranks 7th in type 2 diabetes mellitus this is the leading determinant of high incidence of gestational diabetes mellitus. Although gestational diabetes is labeled when glucose level is raised after 24 weeks of gestation but, whatever is the time of diagnosis, GDM must be considered as high risk pregnancy as it has its effect on mothers and child health.(4) The prevalence of GDM among the developing countries is increasing worldwide more than 30% and increasing the burden of disease over health system.(5) Where the global prevalence of disease has found to be 16.9% according to WHO.(6) The high proportion of females developing GDM may be due to age of parity, obesity or diagnostic criteria of disease. This high prevalence of disease must be controlled by proper strategies and health planning in order to improve maternal and child health. Education and health literacy must be imparted among females of reproductive age group. Early diagnosis and lifestyle modification will reduce the burden of disease.(4) Maternal ethnicity also affects the incidence of GDM. It might be because of genetic predisposition, family history of diabetes , age of parity and lifestyle. Pakistani women are found to have more incidence of GDM.(3)

The risk factors associated with GDM includes age of women, number of pregnancies, previous history of diabetes, obesity, family history, multiparity, life style, and ethnicity.(7) Some of these factors like hereditary and genetic predisposition are not in control but other factors can be controlled to reduce the incidence and prevalence of disease.

Outcome of gestational diabetes mellitus on pregnancy includes both effects on fetus and mother. The child born may be large for gestational age, risk for macrosomia, hypoglycemia just after birth are the immediate effects. This child late in life may have diabetes. Pathophysiology of hypoglycemia is the impaired concentration gradient between mother and fetal glucose level.(6) The mother is at risk of developing hypertension and pre-eclampsia during pregnancy and have increase chances of cesarean section.(8) The prevalence of type 2 diabetes mellitus is increased among women who had GDM.(9)

The early diagnosis and prompt treatment will reduce the adverse outcome of GDM on mother and child.(10) The role of primary health care and antenatal services is of prime importance in order to improve mother and child health. The aim of this study is to identify the risk factors that lead to GDM in pregnant women and to determine the outcome of gestational diabetes in mother

and child health. The rationale of this study is to highlight the factors and enforce the future experimental research to reduce the poor health outcomes of GDM in pregnancy.

METHODOLOGY

An analytical study was conducted at the department of Gynae & Obs, Al-Nafees Medical College and Hospital, Islamabad for a period of one year and 9 months starting from July 2019 to March 2021. All the pregnant females who were diagnosed with gestational diabetes (by oral glucose tolerance test) and were booked patients were included in study at time of their admission. Through a convenient method 150 pregnant females who were on follow-up in hospital were studied. The data was obtained from their previous record of antenatal period. Age, weight, height, body mass index (BMI=self-reported pre-pregnancy), gestational period, last menstrual period (LMP), parity, previous history of gestational diabetes, family history of diabetes along with required laboratory investigations that included oral glucose tolerance test, HBA1c and thyroid function test were taken as independent variables and pregnancy outcome was considered as dependent variable. The pregnancy outcomes were divided into maternal and neonatal outcomes; macrosomia (weight >4000g) neonatal death, hypoglycemia. Maternal outcomes were eclampsia, hypertension, and maternal death.

Data was analyzed on SPSS version 26. The mean, standard deviation and range of continuous variables were calculated. The frequency of categorical variables was expressed in percentages and association of variables was determined with pregnancy outcome. Chi- square test of significance was applied with level of significance taken as $p<0.05$.

RESULTS

In our study 150 females were of mean age 33.91 with ±3.72 SD. The mean weight in Kg was 77.4 (±8.67 SD) and mean height in meter was 1.61. So the mean self-reported, pre-pregnancy BMI(Kg/m^2) of all pregnant females was 29.89 with ±4.55 SD. The mean number of children born to female was 3.4. Table 1 shows the characteristics of neonates and pregnant females with gestational diabetes mellitus (GDM).

Table 1: characteristics of neonate and pregnant females with GDM

Characteristics	Mean (± SD)
Age ,y	33.91 (3.72)
BMI (kg/m^2)	29.89 (4.55)
Gravida	3.4 (1.33)
Neonatal weight(g)	3717.0(441.0)
HbA1c (%)	6.1 (0.63)
Maternal hypertension n(%)	84(56)
Cesarian section n(%)	78(52)
Macrosomia n(%)	48(32)
Neonatal hypoglycemia n(%)	89(59.3)

Fifty-four (34.8%) females were having positive family history of diabetes mellitus and 96(61.9%) were either having no family history or were not sure. Only 16(9.5%) pregnant females were diagnosed previously with diabetes mellitus. Remaining 134(79.8%) were newly diagnosed with gestational diabetes mellitus.

There is no significant association of gestational period with neonatal or maternal death. The p- value with maternal death was 0.410 and with neonatal death it was 0.308 after applying the chi square test of significance, where p-value<0.05 was considered as significant value.

Neonates who developed hypoglycemia just after birth and were sent to intensive care unit were 89(59.3%) and 3(3.37%) neonates died due to complications. Forty-eight (32%) neonates were born with macrosomia. Four (25%) neonates born to known diabetic patients had macrosomia (p=0.52). The linear regression for HBA1c and neonate weight showed no significant correlation with p=0.062.

Box plot (figure 1) describes the frequency distribution of body mass index (kg/ m^2) of pregnant females with their age in years. Females from 30 to 35 years have more BMI as compared to older age group.

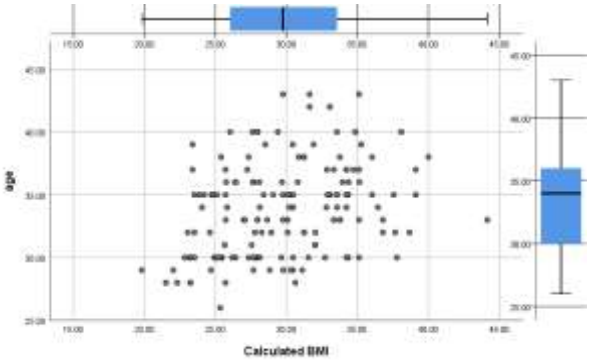

Figure 1: Frequency distribution of body mass index among different age groups of pregnant females.

The gestational diabetes mellitus is associated with cesarian section as 78(52%) females underwent elective c-section. Among these females 84(56%) developed hypertension and 18(21%) were managed for eclampsia. Neonates born with macrosomia were 48 (32%) and with hypoglycemia just after birth were 89 (59.3%).

DISCUSSION

In this observational study all the females that developed gestational diabetes were in the middle age group that is in the range from 30 to 35 years of age. These females were having family history of diabetes mellitus and some had previously diagnosed diabetes. The pre-pregnancy diabetes was determined by HbA1C (>6.5%) which was observed in 9.5% pregnant females with GDM. Pre-pregnancy diabetes is the important factor in causing gestational diabetes so its early diagnosis and management is important in high risk pregnancy.(6) Maternal and fetal monitoring is important in order to reduce the complications due to diabetes. Both antennal and postnatal plasma glucose level should be monitored and controlled.(2) Family history of diabetes was reported by 34.8% females, which is an important and non-modifiable predisposing factor. No independent relationship between gestational diabetes and family history has been established.(11)

Self-reported pre-pregnancy mean body mass index of females showed grade 1 obesity according to WHO classification of BMI (>29.9kg/m^2).(12) Maternal obesity before and after pregnancy are leading to adverse fetal and mother outcomes. Neonates are at increased risk of macrosomia and hypoglycemia. Mother may develop GDM and may undergo cesarian sections due to large for gestation period.(13) Neonates born to obese mothers had macrosomia (35%) and they developed hypoglycemia (59.3%) just after birth. As obesity is a predisposing factor to GDM so neonates are at increased risk to develop macrosomia and hypoglycemia. But no direct association has been established. A study showed that 15-45% Neonates born to mother with GDM may develop macrosomia.(14) In another study 39% neonates developed hypoglycemia due to GDM.(15) All these factors are associated with gestational diabetes. Such pregnancies should be maintained with a proper nutrition plan in order to avoid poor pregnancy outcomes. Although no direct association has been established with hypertension and eclampsia in our study, these are also related to poor pregnancy outcome in pregnant females with GDM. As there are other confounders that influence the outcome of pregnancy, that includes age of patient, multiparity and genetic predisposition.

Maternal diabetes as determined by HbA1c level showed no significant correlation with neonatal outcome for macrosomia

(p=0.062). Where another study shows significant correlation of macrosomia with maternal A1c (p=0.02).(16) It may refer to relation between GDM and macrosomia (32%). The outcome of the pregnancy that includes macrosomia and hypoglycemia are correlated to GDM.(17)

The maternal and neonatal morbidity due to gestational diabetes mellitus can be controlled by early diagnosis and proper antenatal and post-natal care. Management can be done by educating females about their diet and glycemic control to avoid weight gain and hyperglycemia. Medicines are advised when required to control the glucose level. These are required to prevent hypoglycemia in neonate just after birth.(6, 18)

Future implications of our study are to prevent and control the complications of pregnancy outcome in females with pre-diabetes and gestational diabetes. Prevention from developing the disease is important among females of the reproductive age group by reducing the modifiable risk factors.

CONCLUSION

Our study concludes that gestational diabetes mellitus among pregnant females is due to certain factors. These risk factors are not directly associated with the outcome of pregnancy, however GDM is related to outcomes like hypoglycemia and macrosomia in neonates and hyperglycemia, preeclampsia and cesarian section in mothers. Early diagnosis and management is important to prevent the adverse outcome of pregnancy. The mortality is less but the neonatal and maternal morbidity is high with gestational diabetes mellitus.

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