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Congital heart disease detection by echo cardiography in infants of diabetics mothers

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***Abstract*---**We have performed this study with the purpose of determining the relationships between various types of maternal diabetes, glycemic control and the prevalence of various types of cardiovascular complications in neonates and comparing these findings to infants of non-diabetic mothers. A retrospective case-control study was performed between the years 2019-2022 on two groups of newborns at … hospital, IRAQ. Sixty-one mothers were included in this study. The case group consisted of infants born to mothers with diabetes, and the control group was made up of infants born to non-diabetic mothers. Diagnostic criteria for diabetes have been made according to WHO criteria and diagnosis of GDM were based on the recommendations of the Second International Conference (1,2). Both groups were selected using an easy and simple sampling method. Inclusion criteria for the case group were: infants born to mothers with diabetes, term infants, and mothers who received prenatal care. After the selection of the two infant groups-infants with diabetic mothers and infants with non-diabetic mothersgeneral information was recorded, including: age, gender, birth weight and gestational age at birth, Apgar score at birth, echocardiography records of newborns, clinical manifestations, maternal age, history of maternal disease, the type and duration of diabetes diagnosis and treatment, records of previous pregnancies and the presence of or lack of prenatal care. Information for mothers and infants was collected from the data records. Physical examinations were performed by a gynecologist and a pediatrician. The echocardiography was done by a cardiologist. Echocardiography was also performed on healthy infants. Data were analyzed by SPSS Version 23.0 software. Thus, in a total of 61 studied infants, 50 cases (82%) of cardiovascular anomalies have been diagnosed. All 50 babies

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from the case group were diagnosed with congenital anomalies such as atrial septal defect, patent ductus arteriosus, patent foramen ovale and hypertrophic cardiomyopathy which merely require supportive care and follow-ups. In conclusion, Early diagnostic procedures can lead to better supportive care for infants of diabetic mothers. However, special care to infants of diabetic mothers is essential to prevent complications such as respiratory distress, sepsis, and hypoglycemia.

***Keywords*---**diabetes, echo, infant, mother.

Introduction

Congenital cardiac anomalies are the most common type of birth defect, and the incidence of these anomalies is estimated at 6 to 8 cases in 1000 live births. The cause of this anomaly is usually unknown, with 1% of all cases relating to diabetes of pregnant mothers.(1) Prior studies indicate that maternal diabetes has teratogenic effects on the evolution of the fetal cardiovascular system, which increases the risk of anomalies by 1.7 - 4% in published studies.(2,3-8) With congenital heart disease occurring in up to 5% of fetuses of diabetic mothers, and with 90% of the cardiac lesions identifiable prenatally, it has been suggested that detailed fetal echocardiography is offered to all diabetic women during pregnancy.(9-13) However, when studied in relation to maternal initial HbA1c, the overall sensitivity for identifying congenital heart disease was 50% and specificity 54% and no critical level of HbA1c that provided optimal predictive power for congenital heart disease screening was identified.(14)

The risk of gestational diabetes increases with maternal overweight and obesity, advanced maternal age at conception (> 30 years), presence of glucosuria on more than two occasions, previous history of gestational diabetes, family history of type-2 DM, polycystic ovary syndrome, polyhydramnios, male foetus, multiple pregnancy, previous big baby (> 4 kg), ethnicity (non-white ancestry), lifestyle (physical inactivity before and during pregnancy), environmental (as cigarette smoking, persistent organic pollutants, and endocrine disruptors), and psychosocial factors (as depression in the first or second trimester)(15). In a normal pregnancy, there is a 30% increase in basal endogenous glucose production (primarily hepatic) by the end of pregnancy despite the high fasting insulin levels. However, hypoglycaemia could occur in early pregnancy due to increased plasma volume (dilutional hypoglycaemia) and in late pregnancy due to increased glucose utilization. In addition, peripheral insulin sensitivity may decrease by approximately 50% by late gestation, which induces an increase in insulin secretion by 2–3-folds in women with normal glucose tolerance and may disturb the maternal amino acids and lipid metabolism (16-17). In gestational diabetes, β- cell dysfunction could occur because of the additional stress on β-cells due to excessive gestational weight gain and the uprising insulin resistance; or due to β- cells damage caused by autoantibodies against specific β- cell antigens. In gestational DM, the rate of insulin-stimulated glucose uptake is reduced by 54% compared to the normal pregnancy (18). For this reason, we have performed this study with the purpose of determining the relationships between various types of maternal diabetes, glycemic control and the prevalence of various

types of cardiovascular complications in neonates and comparing these findings to infants of non-diabetic mothers.

Materials and Methods

A retrospective case-control study was performed between the years 2019-2022 on two groups of newborns at …….. hospital, IRAQ. Sixty-one mothers were included in this study. The case group consisted of infants born to mothers with diabetes, and the control group was made up of infants born to non-diabetic mothers. Diagnostic criteria for diabetes have been made according to WHO criteria. Both groups were selected using an easy and simple sampling method. Inclusion criteria for the case group were: infants born to mothers with diabetes, term infants, and mothers who received prenatal care.

After the selection of the two infant groups-infants with diabetic mothers and infants with non-diabetic mothersgeneral information was recorded, including: age, gender, birth weight and gestational age at birth, Apgar score at birth, echocardiography records of newborns, clinical manifestations, maternal age, history of maternal disease, the type and duration of diabetes diagnosis and treatment, records of previous pregnancies and the presence of or lack of prenatal care. Information for mothers and infants was collected from the data records. Physical examinations were performed by a gynecologist and a pediatrician. The echocardiography was done by a cardiologist. Echocardiography was also performed on healthy infants. Data were analyzed by SPSS Version 23.0 software.

Results and Discussion

Data were extracted from medical records, and the descriptive and analytical statistics of this information was duly applied. Some of the relevant information is given in Table 1.

Table 1. Comparison of age /mother age according to diabetic status of patients studied

Variables	GDM	No GDM
Age of infants in days	5.2±0.01	4.9±0.03
Mother age	27.9±0.2	24± 0.1

Thus, in a total of 61 studied infants, 50 cases (82%) of cardiovascular anomalies have been diagnosed. All 50 babies from the case group were diagnosed with congenital anomalies such as atrial septal defect, patent ductus arteriosus, patent foramen ovale and hypertrophic cardiomyopathy which merely require supportive care and follow-ups (Table 2).

Table 2. 2D Echo according to Diabetic status of patients studied

2D Echo	GDM	Non Diabetic
Normal	0 (0%)	11 (100%)
Abnormal (50)	27 (54%)	23 (46%)
PDA	8 (53.3%)	7 (46.7%)

PFO	2 (66.7%)	1 (33.3%)
VSD	3 (50%)	3 (50%)
ASSH	9 (52.9%)	8 (47.1%)
ASD	3 (50%)	3 (50%)
HCMP	1 (100%)	0 (0%)
HOCM	1 (50%)	1(50%)

In this study, the incidence of cardiovascular anomalies in infants of diabetic mothers is significantly higher than the infants of non-diabetic mothers; accordingly, the frequency of anomalies is 2.5 times higher among these infants. The comparable results were also obtained in a similar study performed on 64 infants hospitalized at Vali-e-Asr Hospital in 2004 by Najafian study. (19) These results were also seen in other similar studies conducted by (1,2).

Regarding the current study, the most common cardiac anomalies in infants of diabetic mothers were PDA, PFO, and hypertrophic cardiomyopathy. The prevalence of cardiovascular anomalies for all types of malformations in infants born to diabetic mothers is 42.8% and the incidence of other diseases, such as ventricular septal defect, atrial septal defect, displacement of mediastinal great vessels and valve atresia, is estimated at 11.4%. In the study by Najafian, the prevalence of cardiovascular malformations in infants of diabetic mothers was estimated at 46.9%, and the incidence of VSD was about 3%. (20) Also, in a study performed by Dimitriu et al, the prevalence of cardiac anomalies was reported at 23% regardless of pulmonary hypertension and hypertrophic cardiomyopathy. (21)

In the present study, associated anomalies in infants of diabetic mothers were cleft palate and spina bifida. This could be due to a higher prevalence of cardiovascular anomalies in infants of diabetic mothers compared to the anomalies in other organ systems which is also mentioned in other studies. (2) In that study, 37.6% of the total anomalies consisted of cardiovascular anomalies and, thereafter, skeletal anomalies with an estimation of 14.7%.

However in a study conducted, a greater connection was noted between the prevalence of cardiac anomalies of infants and overt diabetes of the mother.(22) According to our study, the duration of diabetes mellitus both in terms of years of overt diabetes and in months of gestational diabetes during pregnancy did not cause any significant difference in the incidence of cardiovascular anomalies in infants. In a study conducted by Weber, Botti, and Baylen, it was concluded that appropriate glycemic control of the expectant mother could reduce cardiovascular anomalies in her infant.(23) It determined that the effect of glycemic control preventing cardiac anomalies in infants during pregnancy had been underestimated.(23)

Conclusion

Early diagnostic procedures can lead to better supportive care for infants of diabetic mothers. However, special care to infants of diabetic mothers is essential to prevent complications such as respiratory distress, sepsis, and hypoglycemia.

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