DOI: https://doi.org/10.53350/pjmhs20221611141

ORIGINAL ARTICLE

Risk of Congenital Anomalies in Pregnant Women with Type 2 Diabetes

MASOOD AHMED[1], MUJEEB-UR-REHMAN ABRO[2], SANIA[3], BUSHRA NOOR KHUHRO[4], FARUKH IMTIAZ BHANBHRO[5], ABRAR SHAIKH[6]

[1]PGR, [2]Assistant Professor, Diabetes & Endocrinology, Shaheed Mohtarma Benazir Bhutto Medical University/Chandka Medical College, Larkana
[3]Assistant Professor of Obstetrics & Gynaecology, Pir Abdul Qadir Shah Jeelani Institute of Medical Sciences, Gambat
[4]Associate Professor, of Obstetrics & Gynaecology, [5]Associate Professor, Department of Community Medicine, Khairpur Medical College, Khairpur Mirs
[6]Dean, Postgraduate & Research, Pir Abdul Qadir Shah Jeelani Institute of Medical Sciences Gambat
Correspondence to Dr. Masood Ahmed, E-mail: kamranzain@hotmail.com Cell: 0333-7263937

ABSTRACT

Aim: To assess the risk of congenital anomalies in pregnant women with type II diabetes.
Study design: Prospective study
Place and duration of study: Department of Diabetes & Endocrinology, Chandka Medical College Hospital, Larkana from 1st October 2021 to 31st March 2022.
Methodology: Two hundred pregnant women ≥20 weeks of gestation already suffering from type 2 diabetes were enrolled. Information in relation to their anomaly scan was gained through ultrasonography at the 20th to 21st week. The anomalies were identified as inconsequential (minor) and chief and correlated with the HbA1c percentage category.
Results: There were 98 (49%) women who were nulliparous. The poor control as well as worst control HbA_1C groups had highest value of body mass index. Within the congenital anomalies observed the overall rate of any anomaly was seen in patients with worst control while least number was observed in good control. Cardiovascular events followed by Genitourinary or renal issues were highest reported as congenital anomalies in fetus.
Conclusion: There is a high risk of congenital anomalies in pregnant women with type 2 diabetes with cardiovascular anomalies to be the highest in category. HbA_1C ≥11.5% and above is at highest risk of congenital anomalies.
Keywords: Risk, Congenital anomalies, Pregnant woman, Type 2 diabetes

INTRODUCTION

Diabetes is a highly prevalent disease all over the globe. There are various types of diabetes, including type 1, which is insulin-dependent, and type 2, which is non-insulin-dependent. Other types include the formation of diabetes during pregnancy. This type of diabetes mellitus mostly resolves with the completion of gestation. Studies have shown that pre-gestational diabetes due to type 2 diabetes is almost 1% common in pregnant women in the developed world. Those women who are suffering from type 2 diabetes and get pregnant are at a higher risk of spontaneous abortion risk[1-7].

In conditions where type 2 diabetic women do not take care of their sugar levels, there is a serious threat of poor outcomes for their pregnancies. Management of their condition in an increasingly stressful physical environment becomes a difficult task that must be achieved for the health of mother and child[8]. Congenital anomalies are known to be significantly associated with poor glycemic control. Various studies have reported different prevalences of congenital anomalies in pregnant type 2 women. The prevalence ranges between 4.5% and 40%, depending on regional and racial disparities[9].

Cardiac as well as foetal abnormalities of the neural tube have been observed in pregnant type 2 women. These anomalies require surgical correction. [10,11] Unfortunately, the mortality and chronic morbidity rates are much higher in such neonates, even after surgical intervention. [12] Women who have type 2 diabetes and are obese face additional risks during pregnancy. The present study was generated to outline the congenital anomalies observed and their frequency in type 2 pregnant women. The results of this study will assist in a better understanding of the disease and its management protocol.

MATERIALS AND METHODS

This prospective study was conducted at Department of Diabetes & Endocrinology, Chandka Medical College Hospital, Larkana from 1st October 2021 to 31st March 2022 and 200 pregnant women already suffering from type 2 diabetes before been pregnant were enrolled. An informed consent was taken from each participant before their enrolment in the study. Those pregnant women who were suffering from gestational diabetes alone with no previous history of type 2 diabetes were not included in the study. Further exclusion criteria consisted of women <20 weeks pregnancy. Sample size was calculated through considering 20% prevalence of congenital anomalies in type 2 pregnant women. The calculations were performed by WHO sample size calculator with 95% Confidence of interval and 5% margin of error. Complete patient history including parity, body mass index as well as clinical history was documented on a well-structured questionnaire. The value of HbA1C was recorded from their medical records. Information in relation to their anomaly scan was gained through ultrasonography at the 20th to 21st week. The anomalies were identified as inconsequential (minor) and chief. Chief or major anomalies were those which required physical and social dependencies. Data was analyzed using chi square test and odds ration with 95% Confidence Interval by SPSS version 26.0. A p value <0.05 was taken as significant. Permission was granted by Ethical Committee of the institution.

Received on 28-06-2022
Accepted on 18-10-2022

RESULTS

The maternal mean age as observed in all the type 2 pregnant women above 20+ weeks was 31.0±5.475 years with no significant variance within the groups of HbA1C categories. There were 49% women n=98 who were nulliparous. Highest number of nulliparity was observed in good control cases with HbA1C below 7.4% value. The poor control as well as worst control HbA1C groups had highest value of BMI (Table 1).

Within the congenital anomalies observed the overall rate of any anomaly was seen in patients with worst control while least number was observed in good control. There was highest number of cases of abortion reported in worst control of diabetes in type 2 diabetic women with a significant ($p<0.002$) [Fig. 1].

There were more cases of chief anomalies in type 2 diabetic women with highest percentage observed in the very poor control diabetic women. Similarly, worst cases outcomes were seen in minor anomalies such as inconsequential anomaly cases of very poor control. Cardiovascular events followed by Genitourinary (GU) or renal issues were highest reported as congenital anomalies in fetus (Table 2).

The odds ration presented highest value as 5.59 (1.84 to 17.01) in worst control of HbA1C pregnant women for any type of anomaly while inconsequential anomalies were highest in very poor control groups and chief anomalies were also highest in worst control group of HbA1C (Table 3).

Table 1: Maternal Features in relation with HbA1C groups

Variable	Overall sample (n=200)	Good control (n=134)	Poor control (n=38)	Very poor control (n=17)	Worst control (n=11)	P value
Maternal age (years)	31.0±5.475	28.9±6.0	31.10±5.5	31.5±5.6	32.5±4.8	0.80
Nulliparousn(%)	98 (49)	67 (50)	18 (47.36)	8 (47.05)	5 (45.45)	0.95
Body mass index (kg/m^2)	35.05±8.85	33.9±9.5	36.2±8.7	34.7±8.1	36.4±9.1	0.56

≤7.4% =good control, 7.5%–9.4%= poor control, 9.5%–11.4%= very poor control ≥11.5%= worst control

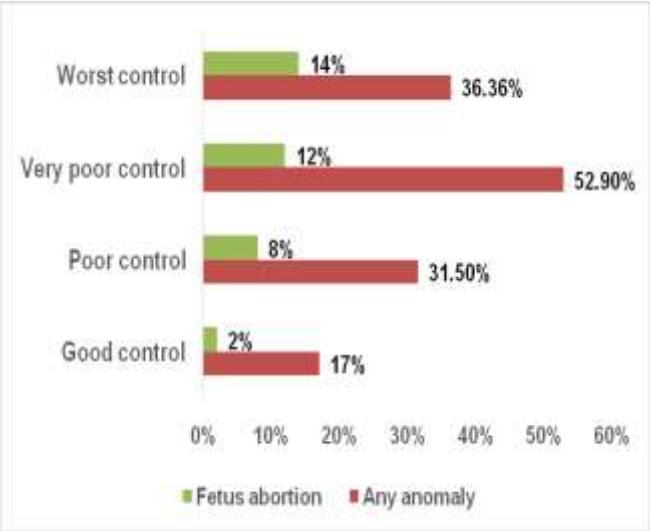
Table 2: Inconsequential and Chief Anomalies observed in fetus

Variable	Overall sample n=200	Good control n=134	Poor control n=38	Very poor control n=17	Worst control n=11	P value
Inconsequential anomaly	**13 (6.5%)**	**7 (5.2%)**	**3 (7.89%)**	**2 (11.7%)**	**1(9.09%)**	**0.38**
Cardiovascular	2 (1%)	1 (0.74%)	1 (2.63%)	-	-	--
Muscular-skeletal	3 (1.5%)	1(0.74%)	1(2.63%)	1 (5.8%)	-	--
GU related	4 (2%)	2 (1.49%)	1(2.63%)	1(5.8%)	-	--
ENT related	2 (1%)	2(1.49%)	-	-	-	--
Multiple reason	1(0.5%)	1(0.74%)	-	-	-	--
Dermatological	1(0.5%)	0-	-	-	1 (9.09%)	--
Chief anomaly	**35 (17.5%)**	**16 (11.9%)**	**9 (23.6%)**	**7 (41.17%)**	**3(27.27%)**	**0.002**
Cardiovascular	15 (7.5%)	6 (37.5%)	5 (13.1%)	2 (11.7%)	2 (18.18%)	
Musculoskeletal or limb	3 (1.5%)	1(0.74%)	1(2.63%)	1(5.8%)	-	--
GU or renal	4 (2%)	2(1.49%)	1(2.63%)	-	1(9.09%)	--
Central nervous system related	3 (1.5%)	2(1.49%)	-	1(5.8%)	-	-
Gastro intestinal related	-	-	-	-	-	-
ENT or facial	1 (0.5%)	-	1(2.63%)	-	-	-
Multiple reason	8 (4%)	5 (3.73%)	1(2.63%)	2 (11.7%)	-	0.001
Dermatological	1(0.%5)	-	-	1(5.8%)	-	-

Table 3: Odds Ration analysis between HbA1C grouping and congenital anomalies observed

Hba1c group	Any fetal anomaly (95% CI)		Inconsequential anomaly (95% CI)		Chiefanomaly (95% CI)	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Good control (n=134)	Used as ref	Used as ref	Used as ref	Used as ref	Used as ref	Used as ref
Poor control (n=38)	2.27 (1.05 to 5.01)	2.36 (1.18 to 5.14)	1.48 (0.36 to 5.88)	2.08 (0.49 to 9.01)	2.51 (1.07 to 6.0)	2.36 (1.01 to 5.45)
Very poor control (n=17)	3.26 (1.23 to 8.64)	2.86 (1.08 to 7.59)	2.27 (0.45 to 11.6)	2.22 (0.42 to 11.6)	3.64 (1.28 to 10.4)	3.18 (1.12 to 9.05)
Worst control (n=11)	5.59 (1.84 to 17.01)	7.65 (2.37 to 25.9)	1.91 (0.32 to 16.5)	1.77 (0.18 to 17.1)	5.80 (1.77 to 18.91)	7.78 (2.16 to 27.8)

Fig. 1: Frequency of congenital anomalies seen in pregnant type 2 diabetic women



DISCUSSION

Diabetes mellitus is a widely reported disease all over the globe with high prevalence of this disease to be seen in pregnant women as presentational diabetes. The present study showed that most of the women in late thirties were suffering from greater risk of type 2 diabetes related congenital anomalies during their pregnancies. Studies in other regions of the world have also presented similar data where late thirties as well as women in their forties have a high risk of development of congenital anomalies due to their type 2 diabetic status.[13-15]

Obesity is considered as another additional risk factor in type 2 diabetic women with pregnancy. As due to insulin resistance in these women the risk of cardiovascular anomalies as well as renal issue prevails. Children if born have a high risk for development of congenital diabetes as well as other comorbidities related to either high or low birth weight and growth retardations[16].

The risk of congenital anomalies increases with the increase in HbA1c levels. The patients who are suffering from a value of HbA1C ≥11.5% were at a high risk of development of cardiovascular or renal related congenital anomalies. In the present study results the value of odds ratio clearly stated that high risk of fetal anomalies was involved in that type 2 pregnant women who were having a worst control of their diabetic status[17-19].

There are international forums such as American Diabetic Association which recommends that all women who are suffering from type 2 diabetes and are pregnant required counselling sessions in context to their glycemic control. A care must also be taken in controlling contraception for avoiding fetal anomalies and birth related defects in neonates. There has been various awareness campaign generated in developed countries and a dire need of the same is required in developing world to avoid the high risk of congenital anomalies[11].

CONCLUSION

There is a high risk of congenital anomalies in pregnant women with type 2 diabetes with cardiovascular anomalies to be the highest in category. The risk of anomaly increases with the poor diabetic control as presented through HbA1C levels. HbA1C ≥11.5% and above is at highest risk of congenital anomalies.

Conflict of interest: Nil

REFERENCES

1. Deputy NP, Kim SY, Conrey EJ, Bullard KM. Prevalence and changes in preexisting diabetes and gestational diabetes among women who had a live birth - United States, 2012-2016. MMWR 2018; 67:1201-7.
2. Hayes DK, Fan AZ, Smith RA. Trends in selected chronic conditions and behavioral risk factors among women of reproductive age, behavioral risk factor surveillance system, 2001-2009. Prev Chronic Dis 2011;8:A120.
3. Mills JL, Simpson JL, Driscoll SG, Jovanovic-Peterson L, Allen MV, Aarons JH, et al. Incidence of spontaneous abortion among normal women and insulin-dependent diabetic women whose pregnancies

were identified within 21 days of conception. N Engl J Med 1988;319:1617-23.
4. Starikov R, Dudley D, Reddy UM. Stillbirth in the pregnancy complicated by diabetes. Curr Diab Rep 2015;15:11.
5. Ladfors L, Shaat N, Wiberg N, Katasarou A, Berntorp K, Kristensen K. Fetal overgrowth in women with type 1 and type 2 diabetes mellitus. PLoS One 2017; 12(11): e0187917.
6. Callec R, Perdriolle-Galet E, Sery GA, Morel O. Type 2 diabetes in pregnancy: rates of fetal malformations and level of preconception care. J Obstet Gynaecol 2014;34(7):648-9.
7. Greene MF, Hare JW, Cloherty JP, Benacerraf BR, Soeldner JS. First-Trimester hemoglobin A1 and risk for major malformation and spontaneous abortion in diabetic pregnancy. Teratology 1989;39(3):225-31.
8. Balsells M, García-Patterson A, Gich I, Corcoy R. Maternal and fetal outcome in women with type 2 versus type 1 diabetes mellitus: a systematic review and metaanalysis. J Clin Endocrinol Metab 2009;94(11):4284-91.
9. Ylinen K, Aula P, Stenman UH, Kesaniemi-Kukkoanen T, Teramo K. Risk of minor and major fetal malformations in diabetics with high haemoglobin A1c values in early pregnancy. Br Med J 1984;289(6441):345-6.
10. Eriksen NB, Damm P, Mathiesen ER, Ringholm L. The prevalence of congenital malformations is still higher in pregnant women with pregestational diabetes despite near-normal HbA1c: a literature review. J Matern Fetal Neonatal Med 2019;32(8):1225-9.
11. Ludvigsson JF, Neovius M, Söderling J, Gudbjornsdottir S, Svensson AM, Franzen S, et al. Periconception glycaemic control in women with type 1 diabetes and risk of major birth defects: population based cohort study in Sweden. BMJ 2018;362:k2638.
12. Tinker SC, Gilboa SM, Moore CA, Waller DK, Simeone RK, Kim SY, et al. Specific birth defects in pregnancies of women with diabetes: National birth defects prevention study, 1997-2011. Am J Obstet Gynecol 2020;222(2):176.e1-11.
13. Spector LG, Menk JS, Knight JH, McCracken C, Thomas AS, Vinocur JM, et al. Trends in long-term mortality after congenital heart surgery. J Am Coll Cardiol 2018;71(21):2434-46.
14. Jovanovič L, Liang Y, Weng W, Hamilton M, Chen L, Wintfeld N. Trends in the incidence of diabetes, its clinical sequelae, and associated costs in pregnancy. Diabetes Metab Res Rev 2015;31(7):707-16.
15. Peng TY, Ehrlich SF, Crites Y, Kitzmiller Jl, Kuzniewicz MW, Hedderson MH, et al. Trends and racial and ethnic disparities in the prevalence of pregestational type 1 and type 2 diabetes in Northern California: 1996-2014. Am J Obstet Gynecol 2017;216(2):177.e1-8.
16. Slot A, Eriksen NB, Ringholm L, Damm P, Mathiesen ER. Congenital heart defects in offspring of women with type 2 diabetes - a systematic review. Dan Med J 2019; 66(6): A5543.
17. Øyen N, Diaz LJ, Leirgul E, Boyd HA, Priest J, Mathiesen ER, et al. Prepregnancy diabetes and offspring risk of congenital heart disease: a nationwide cohort study. Circulation 2016; 133(23): 2243-53.
18. Liu S, Rouleau J, León JA, Sauve R, Joseph KS, Ray JG, et al. Impact of pre-pregnancy diabetes mellitus on congenital anomalies, Canada, 2002-2012. Health Promot Chronic Dis Prev Can 2015;35(5):79-84.
19. Leirgul E, Brodwall K, Greve G, Vollset SE, Holmstrom H, Tell GS, et al. Maternal diabetes, birth weight, and neonatal risk of congenital heart defects in Norway, 1994-2009. Obstet Gynecol 2016;128(5):1116-25.