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Original Research Article

Risk of type 2 diabetes mellitus among women with gestational diabetes mellitus in semi-urban area, Thiruvallur district, Tamil Nadu: a case control study

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) is one of the risk factors associated with type 2 diabetes mellitus. Hence early detection by screening and management of GDM is very essential to reduce the burden of type 2 diabetes. Objectives was to evaluate the strength of association of GDM and type 2 diabetes among women aged 30 to 35 years in Thiruvallur District, to find the association of other risk factors with type 2 diabetes.
Methods: A study was conducted among 160 women with 44 cases and 116 controls aged 30-35 years attending NCD clinics in Thiruvallur District between March and September 2016. The cases and controls were matched for age and time period between last delivery and the time of screening as 5 years or more. GDM exposure was ascertained if their venous blood glucose levels during their antenatal and postpartum period exceeded the oral glucose tolerance test criteria recommended by national guidelines.
Results: In the study it was found that women with history of GDM are 4.65 times higher at risk of developing type 2 diabetes. There was significant association (p=0.000) between type 2 diabetes and risk factors like family history of diabetes, co-morbidities like hypertension, hypothyroidism.
Conclusions: Gestational diabetes is a predictor of type 2 diabetes, as the women are registered in the pregnancy and infant cohort monitoring and evaluation system, it has the potential to identify women at risk of type 2 diabetes and intervene at the earliest.

Keywords: Early onset, Gestational diabetes, Risk factor, Type 2 diabetes

INTRODUCTION

Diabetes is recognized as a group of heterogeneous disorders with the common elements of hyperglycaemia and glucose intolerance, due to insulin deficiency, impaired effectiveness of insulin action, or both.[1] It is found in most populations of the world, and the International Diabetes Federation (IDF) Diabetes Atlas 2011, has predicted that from approximately 366 million people in 2011, the number of diabetics is projected to increase to 552 million people by 2030 if effective preventive programmes are not put into place.[2]

Diabetes is a major public health problem in India with the second largest number of people with diabetes in the world (62.4 million) and this number is expected to reach 100 million by the year 2030, prevalence rates reported to be between 4.6% and 14% in urban areas and 1.7% and 13.2% in rural areas.[3] In a community-based study in Tamil Nadu, the prevalence of GDM was found to be

17.8% in urban, 13.8% in semi urban and 9.9% in rural areas.[4] In Haryana the prevalence of GDM was found to be 7.1% in urban area and 13.9% among rural women.[5,6] In another study in Tamil Nadu the overall prevalence of GDM was 14.1% with no significant urban/rural difference.[7] The prevalence of gestational diabetes has been reported to be 7.8% in Kashmir.[8] 9.5% in Western India and as high as 35% from Punjab and 41% from Lucknow.[9] The geographical differences in prevalence have been attributed to differences in age and/or socioeconomic status of pregnant women in these regions. It is estimated that about 4 million women are affected by GDM in India, at any given point in time.[10] Gestational diabetes (GDM) is defined as a variable degree of carbohydrate intolerance that is first acknowledged in pregnancy and though it is a well-known cause of pregnancy complications, its epidemiology has not been studied systematically.[11,12]

Many studies have made an attempt to identify subgroups of women who are more likely to develop type 2 diabetes later in life. The results of these studies have been inconsistent and sometimes contradictory.[13]

The objectives of the study were to evaluate the strength of association of GDM and development of Type 2 diabetes among women aged 30 to 35 years in Thiruvallur District and to find the association of various other risk factors with type 2 diabetes mellitus.

METHODS

This is a facility-based case control study of secondary data in a semi urban area. The study subjects were chosen from the registers of the non-communicable disease (NCD) clinics in primary health centers and government hospital of Thiruvallur district. It is a retrospective case control study conducted among female subjects aged between 30-35 years attending Government hospital and primary health center NCD clinics in Thiruvallur District from March 2016 to September 2016. After discussion with the chairman of the Institutional ethics committee, formal approval was deemed not necessary as this was retrospective study based on secondary data from the records from the Tamil Nadu health systems project and pregnancy and infant cohort monitoring and evaluation databases.

The Government of Tamil Nadu, in partnership with the World Bank, established in 2005, the Tamil Nadu health systems project, to create a health system in Tamil Nadu that is highly accessible, equitable and effective.[14] Through this project Tamil Nadu state initiated opportunistic screening of men and women aged 30 years and above using standard guidelines for non-communicable diseases for early hypertension, type 2 diabetes mellitus and in women for breast and cancer cervix since 2007 at non-communicable disease clinics (NCD clinics) located in primary health centres and government hospitals run by an exclusive category of staff nurses called NCD staff nurses who were trained in screening and online data entry of the data of the screened population which predates the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular diseases and Stroke (NPCDCS) initiated by Government of India in 2010. In this study the study has chosen the participants from these screening sites of NCD clinics at Thiruvallur and we used pregnancy infant cohort monitoring and evaluation (PICME) software to ascertain GDM status.

Pregnancy and infant cohort monitoring and evaluation (PICME) is a software developed by National Informatics Centre, Chennai and implemented since 1st April 2008, initially in rural areas and later in the urban areas which facilitates online evaluation and monitoring of mother and child health. The ultimate objective of the software is to achieve reduction in maternal mortality ratio and infant mortality rate in the state. Under this system, the mothers are given a unique Identity number called PICME number. PICME registers the service received details of pregnant women starting from ante-natal registration till the 1st birthday of the infant. Details of the mother can be viewed from anywhere with their PICME number.[15,16] The data is used for high risk cases referral and monitoring.[17] Through this system antenatal mothers who fall under the 30 high risk conditions prefixed in PICME system were put under close monitoring and referral done if necessary. One among the high risk conditions entered in PICME is gestational diabetes mellitus and that data were used to back trace the oral glucose tolerance test reports of cases and controls.

Method of selecting the study subjects from the NCD registers, women aged between 30 and 35 years attending the clinics and receiving treatment for type 2 diabetes were chosen as the cases. They were diagnosed after screening by random blood sugar testing done using semi-automated analyzer method followed by fasting and postprandial venous blood sugar levels as per Tamil Nadu health system project (TNHSP) state NCD guidelines. Nulliparous and women with type I diabetes mellitus were excluded from the study.

Those who were screened for type 2 diabetes and having normal blood sugar were the controls. The cases and controls were matched for age. They were also matched for the time period between last delivery and the time of screening as 5 years or more. GDM exposure was ascertained if their venous blood glucose levels during their antenatal and postpartum period exceeded the oral glucose tolerance test (OGTT) criteria recommended by national guidelines.

Keeping the two-sided confidence level (1-alpha) 95, power 80%, ratio of controls to cases 3, and assuming the proportion of controls with history of GDM 0.18% and proportion of cases with exposure 13.1% at 5 years after delivery, a sample size of cases to be 39 and sample size of controls to be 116. The final sample size was 160 with 44 cases and 116 controls.[18]

Operational definitions

Type 2 diabetes: Anyone with fasting blood sugar value of more than or equal to 126mg/dl or postprandial blood sugar value of more than or equal to 200mg/dl were chosen as cases.

GDM: Diagnosis were made on PICME records as per the National guidelines for GDM and treated accordingly. National guideline for diagnosis and management of Gestational Diabetes endorses the single step test recommended by WHO for diagnosis of GDM using a 75gm glucose, through OGTT irrespective of the last meal with a threshold value of 2-hour blood sugar >140 mg/dL.

Analysis: Data was entered into Microsoft excel data sheet and was analyzed using SPSS software. Categorical data was represented in the form of proportions. Chi-square test was used as test of significance for qualitative data. The odds ratio was calculated to assess the strength of association between the GDM and type 2 diabetes cases. Various other risk factors like body mass index, age, religion, education, family history of diabetes and occupation, were also assessed for association with type 2 diabetes using inferential statistics. Continuous data was represented as mean and standard deviation. p value of <0.05 was considered as statistically significant. Open Epi, and Mendley's desktop were used to estimate sample size, and reference management in the study.

RESULTS

The study population consisted of 160 subjects with 44 cases and 116 controls in the ratio of 1:3. The mean age of cases in the study was 32 (±2) years and those of controls was 33 (±2) years. The mean age at delivery for the cases was 25 (±1) years while those in Control group was 24.9 (±1.3) years

Table 1: Demographic profile of subjects in the study.

Demographic profile		Cases		Controls		P value
		Count	%	Count	%	
Religion	Christian	3	6.8	8	6.9	0.813
	Hindu	40	90.9	104	89.7	
	Muslim	1	2.3	4	3.4	
Education	Illiterate	6	13.6	21	18.1	0.401
	Primary schooling	7	15.9	14	12.1	
	8th standard	14	31.8	30	25.9	
	Matriculation	5	11.4	29	25	
	Higher secondary	9	20.5	16	13.8	
	Graduate and above	3	6.8	6	5.2	
Occupation	Farmer	0	0	8	6.9	0.332
	House wife	43	97.7	102	90.6	
	Tailor	1	2.3	1	0.9	
	Teacher	0	0	2	1.7	

Table 2: Body mass index (BMI) classification of subjects.

Body mass index		Cases (n=44)		Controls (n=116)		p value
		Count	%	Count	%	
BMI	Underweight (<18.5)	3	6.8	4	3.4	0.804
	Normal (18.51-24.99)	21	47.7	54	46.6	
	Overweight (25-29.99)	15	34.1	39	33.6	
	Obese class 1 (30-34.99)	3	6.8	13	11.2	
	Obese class 2 (35-39.99)	2	4.5	4	3.4	
	Obese class 3 (>40)	0	0	2	1.7	

Table 3: Strength of association between GDM and risk factors.

	Cases (n=44)	%	Controls (n=116)	%	Odds ratio	P value
Family history of DM	40	90.9	90	77.58	2.89	0.039
GDM	34	77.3	49	42.2	4.65	0.000
Co-morbidity	18	40.91	9	7.8	8.2	0.000

Difference in groups was not observed among the educational status of the population, with 31.8% having completed 8th standard followed by higher secondary (20.5%) among the cases, while the control group had 25.9% having completed 8th standard followed by matriculation (25%) and illiterate (18.1%). There was no significant difference between the groups based of their occupation, with house wives constituting 97.7% of the cases and 90.6% of the controls.

The mean height among the cases was 158.14 (±6.46) cms and that among controls was 157.71 (±6.46) cms. The difference in height, weight or BMI was not significant. No difference was observed between the different BMI category and the two groups.

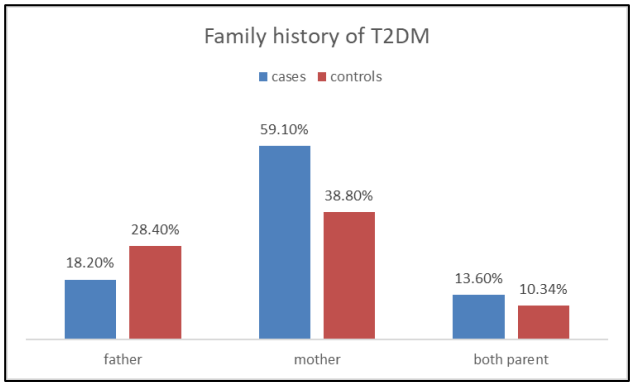

Figure 1: Family members with history of diabetes among the subjects.

Among the cases, 63.7% and among controls 38.8% had positive family history of diabetes. Those with family history of diabetes had 2.89 times more risk of developing diabetes mellitus. It was also found that the difference was statistically significant (p=0.032) between diabetic subject's mothers with positive history of diabetes.

Among the cases, 77.3% had history of gestational diabetes mellitus and among the control 42.2% had GDM and the difference was statistically significant (p=0.000). Those who had GDM were 4.65 times more at risk of developing type 2 diabetes than others. Presence of co-morbidities like hypertension, hypothyroidism was 8.2 times more among the cases and was statistically significant (p=0.000).

DISCUSSION

The prevalence of diabetes is growing to epidemic proportions and presents a public health challenge. GDM though has its own inherent adverse impacts on pregnancy outcomes and perinatal morbidity, is also a predictor of developing type 2 DM later in life.[19] This study shows that women who had diabetes during antenatal period are at higher risk of developing Type 2 diabetes later in life and the risk was estimated to be 4.65 times higher. Studies have estimated that among the South-east Asian countries, India (13.6%) has the second highest the prevalence of GDM. Studies have also shown that the prevalence of GDM varies according to the inherent characteristics of the study population. Indian women were twice as likely to develop GDM as compared to their American counterparts, independent of age, parity, height and BMI in a study among 133,552 live deliveries in Florida.[20] Some studies have shown that the progression to type 2 diabetes increased steeply within the first 5 years after delivery, and then appeared to plateau. The progression of insulin resistance depends on the elevated fasting glucose levels during pregnancy.[21]

Type 2 diabetes is frequently accompanied by one or more components of metabolic syndrome such as obesity, dyslipidemia, and hypertension. In this study also there was a positive association between type 2 diabetes and comorbidities like hypertension and hypothyroidism. Patients with type 2 diabetes often have irregular diet patterns, which deleteriously influences glucose control, lipid metabolism, and micronutrient intake and as it is progressive can lead to several complications related to poor glucose regulation.[22]

The study showed that there was 2.89 times increased risk of family history and type 2 diabetes. Family history of diabetes is a known risk factor for the disease and is also positively associated with risk awareness and risk-reducing behaviors. It may provide a useful screening tool for detection and prevention of diabetes.[23]

Studies worldwide have consistently shown that screening for diabetes in women with prior gestational diabetes is sporadic for a variety of reasons.[13] The lack of a reliable early test for GDM has hampered the development of useful intervention therapies that may impact not only on the acute but long-term health outcomes. Thus, there is a need to diagnose and predict GDM earlier so that appropriate management can be initiated and tailored to the needs of the patient in order to minimise complications and their sequelae.[24]

Though mass screening of general population has not been widely regarded as being efficient, targeted screening of high-risk population is widely deemed as acceptable. The elevated risk of type 2 diabetes in women with a diagnosis of GDM in the antenatal period suggested that these women may benefit from regular screening and preventive interventions. Also, estimating the risk in a precise manner may allow policy makers to estimate the exact cost and potential impact of preventive programs.[18]

Hence the Tamil Nadu state PICME system can play a crucial role in reducing the burden of type 2 diabetes among post-delivery women in the age group less than 30 years, if the baseline data of high risk mothers is used for intervention at the earliest (even before the opportunistic screening through NCD programme).

CONCLUSION

Gestational diabetes is a predictor of type 2 diabetes and the risk is 4.65 times higher within a period of 5years of delivery and is associated with an increased risk of comorbidities. As the women are registered in the PICME system, it has the potential to identify women at risk of type 2 diabetes and intervene at the earliest in order to limit the progression of disease consequence. Meanwhile we recommend that for all women with GDM the life style modifications involving combinations of exercise, diet and behavior modifications routinely advised during their antenatal period should be continued after delivery also to reduce the burden of type 2 diabetes among women with a history of GDM and time bound screening for development of type 2 diabetes should be done every year for early detection and also to prevent complications.

Automatic reminders or notifications sent via mobile numbers to women diagnosed with GDM post-delivery would help to detect postpartum diabetes and guide women regarding subsequent follow-up. The follow up of the mothers with GDM history should be strengthened and the data of their post-delivery OGTT report entry in PICME should be mandated for issuing the final instalment of maternity benefit scheme. Statewide standard guidelines should be developed to follow up women with GDM.

Limitations

The small sample size makes the generalizability of the study to entire Tamil Nadu population limited.

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