Parental Influence on the Spectrum of Type 2 Diabetes Mellitus in the Offspring

Medical Science

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ABSTRACT   **Aim**: To study the family history in Type 2 Diabetes mellitus persons. **Materials and Method**: A hospital based cross sectional study of 6 months duration was planned. The information regarding diabetes was collected from 100 diabetic patients, their parents and their first degree relatives. **Observation**: Among 100 nodal diabetes patients, 17 had paternal influence, 20 had maternal influence and 6 had both mother and father diabetic. The mean age at diagnosis of DM was 38 ± 5.5 years in those with (31%) positive family history and 40.9 ± 4.2 years those with (69%) negative family history in the offspring. This difference is statistically significant (p=0.03). **Conclusion**: There is a strong association with family history. In addition those with a definite family history of diabetes mellitus present with diabetes at early age than those who do not have.

Introduction

Diabetes is a growing public health problem, especially in India. The global burden may reach a level of almost 300 million patients in 2025 with similar alarming increase in India1.

Genetic is a basic of diabetes mellitus. Family history is a good and easier marker for genetics. Stronger the family history, higher is the chance of getting diabetes. Familial clustering of type 2 diabetes (T2D) is well known and is high in Indians2, 3, 4.

Subjects with family history of diabetes develop diabetes earlier compared to subjects without family history 6. Family history of diabetes is a strong factor associated with type 2 diabetes mellitus in young5.

The review of literature from various countries from all over the world reveals that 47 to 82.6 % person of diabetes have a least one diabetic family member. The incidence of parents having diabetes varies from 22.2 to 100%. This indicates a strong familial background. Stronger transmission of diabetes to its progeny from mother or father is a controversial1, 2,3,4,5.

Thus in order to study the influence of the family history on various aspects of diabetic persons the present study was undertaken.

AIM AND OBJECTIVES:

1. To study the family history in Type 2 Diabetes mellitus persons with respect to familial influence, paternal and/or maternal transmission, transmission in first degree relatives.
2. To co-relate family history of Type 2 diabetes with age at onset of diabetes mellitus in parents and offspring

MATERIAL AND METHODS:

- Type of study: Cross Sectional study
- Place of study: Government Medical College, Aurangabad
- Inclusion Criteria:
1. Type 2 diabetic patients attending Out Patient Department, Diabetic clinic, admitted in Medicine wards.
2. Both the parents of diabetes should be alive and available for investigation.
3. Age >30 years.
- Duration of study: 1st August 2007 to 31st July 2009
- Ethical Consideration: Permission of institutional ethical committee and head of institute was obtained before beginning of the study. Informed written consent was taken from each participant. Confidentiality of data was maintained.
- Data Collection Method: Predesigned, pretested proforma
1. Nodal diabetic patient (100): The diabetic patients underwent detailed history, examination and investigation as per the proforma. Special efforts were made for age at diagnosis of DM and anthropometry.
2. Parents (200): Both the parent of nodal diabetic patient underwent detailed history and examination as per the case proforma. Special importance was given to age at diagnosis of diabetes and age a child birth of parent.
3. First degree relatives (592): This means brother, sisters, sons and daughters of the nodal diabetic patient were asked about his / her for first degree relatives. The diagnosis of diabetes amongst these relatives was based only on history given by the patient. They were not investigated.
4. Blood glucose status: Fasting and post meal blood sugar level (BSL mg/dl) by GOD- POD method was taken and described as below.

Random blood glucose level : 11.1 mmol/L (200 mg/dL)
                                                OR
Fasting plasma glucose level : 7.0 mmol/L (126 mg/dL)
                                                OR
Two-hour plasma glucose level : 11.1 mmol/L (200 mg/dL)
                                                during an oral glucose
                                                toler ance test

- Data Analysis: Appropriate descriptive and inferential statistics were applied.

Observation:

The present study was conducted in this institute to study the familial influence in Type 2 diabetes mellitus during the period August 2007 to November 2009. The 'nodal' Type 2 diabetic patient whose parents were available for examination constituted the basic material for the present

study. Such 100 nodal Type 2 diabetic patients were selected who underwent detailed history, anthropometry and blood sugar levels with informed consent as per the case proforma.

There were 200 alive parents of these 100 nodal diabetes patients who also underwent detailed history, blood sugar levels and anthropometry. These 100 nodal Type 2 diabetes patients had 315 first degree same generation relatives, 176 brothers and 139 sisters. They were interrogated as per the questionnaires for diabetes. These 100 nodal Type 2 diabetes patients had 277 first degree next generation relatives, 147 sons and 130 daughters who also underwent detailed questionnaires for diabetes. Thus present study constituted total 892 individuals from 100 diabetic families.

Among these 100 nodal diabetes patients 31 had a definite family history in the form of diabetes among their mothers, fathers or both. 17 had paternal influence, 20 had maternal influence and 6 had both mother and father diabetic. This difference was not significant (p=0.7). **[Table No.1]**

20 diabetic mothers transmitted disease to their 7 male and 13 female diabetic offsprings. Rest 80 nondiabetic mothers had 40 males and 40 female diabetic offsprings. This difference in diabetic and nondiabetic mothers is not significant statistically (p=0.3).17 diabetic fathers transmitted disease to their 10 male and 7 female diabetic offsprings. Rest 83 nondiabetic fathers had 37 male and 43 female offsprings. This difference in diabetic and nondiabetic fathers is not significant statistically (p=0.4).4 male and 2 female nodal diabetic patients had both parents (mother and father) diabetics. Rest 94 nodal diabetic patients had either both mother and father nondiabetic or only one diabetic. This difference was also not statistically significant (p=0.4). **[Table No.2]**

These 100 nodal Type 2 diabetic patients had 315 same generation relatives. Of these 176 (55.9%) were brothers and 139 (44.1%) were sisters. Analysis of these 315 revealed that 7 (3.9%) brothers and 8 (5.7%) sisters were found to be diabetic. These 100 nodal Type 2 diabetes patients had 277 first degree relatives of second generation. Of which 147 (53.1%) were sons and 130 (46.9%) were daughters. Analysis of these 277 revealed that 1 (0.6%) son and 11 (0.7%) daughters had diabetes. **[Table No.3]**

The mean age at diagnosis of DM was 38 ± 5.5 years in those with (31%) positive family history and 40.9 ± 4.2 years those with (69%) negative family history in the offspring. This difference is statistically significant (p=0.03). **[Table No.4]**

The mean age of diagnosis of diabetic fathers was 53.3 ± 5.4 years and 37.5 ± 5.6 years in offsprings (male 37.5 ± 4.2 years & in female 37.5 ± 7.1 years).This difference was statistically significant (p<0.001).The mean age of diagnosis of diabetic mother was 54.5 ± 5.4 years and 39 ± 5.3 years in offsprings (male 37.8 ± 4.7 years & in female 39.6± 5.5 years). This difference was statistically significant (p<0.001). The mean age of diagnosis of both parents was 53.8 ± 5.6 years and 35.8 ± 3.5 years in offsprings (male was 36.7± 6 years and in female 35 ± 1 years). This difference was statistically significant (p=0.005).

Discussion:

Diabetes is a growing public health problem, especially in India. Among the risk factors of diabetes, family history remains an important one. Stronger the family history, stronger is the chance of getting diabetes. The parental transmissions of diabetes provide insight into the relatives attributed of maternal and paternal influ-ences. The studies of family history among Indian population are spared. Thus in order to see the influence of family history on various aspects of diabetes present work was undertaken

Thus the present study comprised of 100 Type 2 diabetic patients (nodal individuals) with their 200 parents, 315 brother and sisters, and 277 sons and daughters. Total amounted to 892 individuals which comprised the material for the present study.

Considering all three generation 43% of our diabetics had at least one close diabetic relative. In 31, the parents had DM and 12 cases it was the diabetes reported in the first degree relatives.

In present study amongst 176 brothers 7 (3.9), amongst 139 sisters 8 (5.7%), amongst 147 sons 1(0.6%) and 130 sisters 11 (7.6%) had diabetes.This incidence of having at least one diabetic relative is similar to various Indian studies 1, 4,5 which showed the incidence to vary from 47% to 50%. However studies6-12 from other countries show a still higher incidence ranging from 36% to 82.6%.This clearly shows that diabetes has a strong family clustering background and needs to it interrogated while interrogating a person.

Among these 100 nodal diabetes patients 31 had a definite family history in the form of diabetes among their mothers, fathers or both. 17 had paternal influence, 20 had maternal influence and 6 had both mother and father diabetic. This difference was not significant (p=0.7). Similar findings regarding positive family history was also observed by B Thorand et al (36.2%) 13 at Germany, SN D Silva et al (37.0%) at Srilanka 10, D Crispim et al (31.6%) at Brazil11, and A Imen et al(34.0%) at Tunisia12. But the studies conducted in India at Chennai by M Vishwanathan et al4 and at Asam by B N Mahanta et al5 revealed comparatively higher proportion of diabetics having positive family history i.e. 22.2% and 74-100% respectively.

In the present study 20 mothers and 17 fathers were found to be diabetic. Thus giving us slight higher maternal transmission rate 20% as compared to parental transmission of 17%.The difference was statistically not significant indicating the transmission occurs equally from mothers as well as from fathers. We did not find excess maternal transmission as compared to parental transmission in present study which is similar to reported by D J Kim et al (2004)14, B Thorand et al (2001)13, and A Ramchandran et al (2007)1 also. However W H Sheu7, R T Erasmus8, S C Lee9, J B Meigs15, B Thorand13, D Crispim11, and A Imen12 had found higher level of maternal transmission than paternal transmission. F Thomas et al (1994) found that mother implicated 2 times more than father (p< 0.001), also reported familial aggregation of diabetes. But, J B Meigs et al (2000)15 reported paternal dominance which is contradictory to the present study

In this present study 6% of diabetic, both fathers and mothers were diabetics. Similar to the present study incidence of both parental transmissions varies from 1.7% to 3% in other studies viz. J B Meigs et al15 (1.7%) and A Imen et al (3%) 12. But a study at Kolkata by S Kumar et al 200816 quoted a higher incidence of 37.5% persons with family history of biparental diabetes.

Mean age of diagnosis of diabetes in fathers and their offsprings was 53.3 ± 5.4 years and 37.5 ± 5.6 years while that in mothers and their offsprings was 54.5 ±

5.4 years and 39 ± 5.3 years respectively. This higher age of diagnosis in fathers and mothers was statistically significant (p<0.001). These findings clearly indicated that irrespective of sex of parents or of their offsprings, the diabetes occurred earlier in the next generation. Similarly A Ramchandran et al (2007)1 also found that age at onset of diabetes was lower in the offspring than in their parents at least by a decade. However such difference was not observed in a study conducted by W H Sheu et al (1999)7, J B Meigs et al (2000)15, and A Imen et al (2007)12.

Conclusion:

Thus to conclude diabetic person has 43% incidence of at least one member positivity of diabetes in the family. There is a strong association with family history. However the maternal / paternal dominance in penetration is controversial and needs further detailed analysis. Diabetes occurs one decade earlier in our population than other countries. In addition those with a definite family history of diabetes mellitus present with diabetes at early age than those who do not have.

Table No.1: Family History of diabetes among the Diabetic Patients

	Diabetic	Nondiabetic	Total
Father	17	83	100
Mother	20	80	100
Both Parents	06	94	100
Total	31*	79*	100*

*Multiple Responses

Table No.2: Transmission of Diabetics to the Offspring

	Diabetic Male Offspring (n=47)	Diabetic Female Offspring (n = 53)	Total (n = 100)
Diabetic Mother	07	13	20
Non diabetic Mother	40	40	80
Diabetic Father	10	07	17
Non diabetic Father	37	46	83
Both parents diabetic	04	02	06
Both parents non diabetic	43	51	94

Table No. 3: Distribution of Diabetes among the First Degree Relatives

	Diabetic	Nondiabetic	Total
First Generation Relatives			
Brothers	07	169	176
Sisters	08	131	139
Total	15	300	315
Second Generation Relatives			
SON	01	146	147
DAUGHTER	10	120	130
Total	11	266	277

Table No.4: Age at Diagnosis of Diabetes and Family History

Family History of diabetes	Total No of participants	Mean Age at diagnosis (years)	SD	p value
Positive	31	38	5.5	0.04
Negative	69	40	4.2	

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