

A study on the prevalence of retinopathy in newly diagnosed Type 2 diabetes mellitus in a tertiary care center of Tamil Nadu



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ABSTRACT

Background: Type 2 diabetes mellitus (Type 2 DM) is an independent risk factor for atherosclerotic cardiovascular disease (ASCVD). Although the awareness of the need for screening and treatment for Type-2 DM is widely prevalent, the awareness of complications arising out of it is not widespread. This article highlights the occurrence of diabetic retinopathy (DR) among newly detected diabetic patients. **Aims and Objectives:** The aim of the study was to study the prevalence of DR in patients who are diagnosed as having Type 2 diabetes mellitus for the first time. **Materials and Methods:** The present study involved 501 newly diagnosed Type 2 DM patients. Their history was recorded and the investigations done included haemoglobin (Hb), glycated Hb percent (HbA1c), fasting blood sugar, and post-prandial blood sugar. These patients underwent fundus examination through direct ophthalmoscope and slit-lamp examination. **Results:** Out of the 501 patients in the study, 59.5% (298) had good knowledge about diabetes, but only 3.8% knew about retinopathy. A total of 71.5% of patients did not have periodic eye examination; the most common barrier identified was lack of awareness about the necessity for this (58.5%), 5.6% among the total population had an eye disease. Mild non-proliferative DR (NPDR) was found among 10 females and it was observed in eight males. Moderate NPDR was identified in three males and two females and while no severe cases were reported among the men, two were noted among the women. **Conclusion:** The study highlights the prevalence of retinopathy in newly diagnosed Type 2 DM population in tertiary care center hospital in Salem district. The study also highlights the importance of detection of Type 2 DM before the occurrence of complications which arise due to diabetes and screening for microvascular complications is necessary at the time of diagnosis of DM and periodically.

Key words: Newly diagnosed diabetes; Type 2 diabetes mellitus; Diabetic retinopathy

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INTRODUCTION

Diabetes mellitus (DM) has become an important public health concern and the global diabetic population is estimated to reach 642 million by 2040.¹ Type 2 DM constitutes 90% of the diabetic population. It predisposes to vascular, renal, ophthalmic, and neurologic complications, impairing quality of life, causing a huge economic burden on the patient and the society. Asian Indians are more prone to diabetes; also, they are more prone to the

complication that occurs due to diabetes mellitus, especially premature coronary artery disease owing to the “Asian Indian phenotype”.² This Asian Indian phenotype refers to unique clinical and biochemical abnormalities that occur amidst Indians include higher waist circumference despite lower body mass index, increased insulin resistance, lower adiponectin, and higher hs-CRP level. The chronic complications arising due to diabetes extend to increased morbidity and mortality. The complications detected at the time of diagnosis can be attributed to the lack of

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awareness of the silent state of diabetes and asymptomatic manifestation.³

Fasting blood sugar (FBS) value of more than 125 mg% is diagnostic criteria of diabetes as per ADA guidelines. This value cutoff was proposed because studies in populations showed increased incidence of retinopathy in persons with FBS value of 126 mg and above on long-term follow-up.⁴ The benefit of early diagnosis of DM with sustained glycemic control, were well explored and supported through various studies across the globe emphasizing a very high prevalence of complications at late diagnosis of diabetes.⁵ Harris et al., extrapolated the relationship of retinopathy prevalence and duration of diabetes and suggested the diagnosis of diabetes was only made after 10–20 years of actual onset of disease.⁶ Diabetic retinopathy (DR) is one of the earliest microvascular complications of diabetes which do not portray any symptoms in initial stages. Early screening for DR is vital for all diabetic patients since earlier detection and management of the retinopathy help in reducing the risk of sight-threatening complications.

Aims and objectives

To evaluate the presence of Diabetic Retinopathy (DR) in newly detected T2DM patients and to study the awareness and prevalence of DR in the newly detected T2DM patients attending the out patient departments of Diabetology and General Medicine in a tertiary care hospital.

MATERIALS AND METHODS

The present study was conducted after getting the Institutional Ethics Committee (Ref No.2626/MEI/PG/2015 dated 29.06.2015) involving 501 newly diagnosed Type 2 diabetes mellitus, after obtaining the consent from the patients among those who attended as outpatients at the Department of Diabetology and General Medicine, Government Mohan Kumaramangalam Medical College Hospital, Salem.

Type 2 diabetes is widely prevalent form of diabetes mellitus affecting a wide range of age groups. The diagnosis is delayed in many patients for various reasons and is apt to present with one or more complications even when being diagnosed for the first time as diabetic. Microvascular complications being one of the leading causes of morbidity due to diabetes Mellitus, DR screening was chosen to assess the presence of microvascular complication as it is relatively simpler to screen and easier to demonstrate. For the above reasons, the sampling was confined to newly diagnosed Type 2 diabetes mellitus patients. The sample size was arrived at considering the population size of about 830,000 in the city with a confidence level of 95% and margin of error of 2.5% with an estimated prevalence of diabetes being about 9% in Indian populations.

The other types of diabetes mellitus were excluded from the present study. The patient's history included age, sex, and details of family member having DM and comorbid illness. Laboratory investigation included Hb, HbA1c, FBS, and postprandial blood sugar (PPBS) (2 h after breakfast). These patients were also subjected to fundus examination at the Institution's Department of Ophthalmology through direct ophthalmoscope and slit-lamp examination using a 90D lens. The diagnosis of DM was made as per the criteria set by the American Diabetes Association.

Statistical analysis

Statistical analysis was performed with Minitab17 and Microsoft Excel.

RESULTS

Out of the 501 patients in the study, 59.5% (298) had good knowledge about diabetes, but only 3.8% knew retinopathy. A total of 71.5% of patients did not have periodic eye examination; the most common barrier identified was lack of awareness about the necessity for this (58.5%).

Mean age among the population was 50.87 ± 9.54 , mean sample FBS (mg/dL) was 199.50 ± 72.18 the lowest recorded at 70 mg/dL and the highest values noted as 463 mg/dL and the mean PPBS (mg/dL) value was arrived at as 322.04 ± 83.17 , with highest and lowest values noted as 147 and 588 mg/dL (Table 1), the mean Hb (g%) was 12.13 ± 1.51 , with the highest 17.3, while the lowest Hb level being 7 g%, and the mean HbA1c value was 8.78 ± 1.82 , with 6.6 being the least and 14.6 the highest noted value (Table 1). The youngest and oldest patients amidst the sample population were recorded as 32 and 82, respectively (Table 1). A strong correlation of sample population's FBS and PPBS was found (correlation co-efficient value of 0.75), similarly a strong correlation was also found between FBS and HbA1c with a value of 0.74 and between PPBS; HbA1c with a value of 0.77. The age of the study population had no correlation on the blood sugar level and HbA1c, likewise the Hb levels also had no impact on these parameters (correlation coefficient values; -0.002 , -0.18 , and 0.09).

Table 1: Mean age, FBS, PPBS, and HbA1c values

Mean age of the patients (in years)		FBS value in mg/dL		Mean PPBS value in mg/dL		Mean HbA1c value as %	
50.87	±9.54	199.50	±72.18	322.04	±83.17	8.78	±1.82
High	Low	High	Low	High	Low	High	Low
82	32	463	70	588	147	14.6	6.6

FBS: Fasting blood sugar, PPBS: Postprandial blood sugar, HbA1c: Glycated hemoglobin A1c

Among the 207 male samples, the mean age was 51.93 ± 10 with the youngest male recorded at 32 and the oldest at 82 (Table 2). The mean FBS and PPBS were recorded as 199.79 ± 71.44 mg/dL and 328.58 ± 84.13 mg/dL, respectively (Tables 3 and 4), along with the mean HbA1c as 8.68 ± 1.75 and a mean Hb level of 12.65 ± 1.42 . The maximal and minimal values for FBS and PPBS being 416; 87 and 588; 152, respectively, while these values for Hb and HbA1c being 17.3; 8 (Table 5) and 14.9; 6.8, respectively (Table 6). A strong correlation between FBS, PPBS, and HbA1c (correlation coefficient values; 0.72, 0.69, and 0.74) was found for the male population, this trend matched with that of the overall sample population although the age did not impact FBS, PPBS, Hb, and HbA1c values.

While among the women (294), the mean age was arrived at 50.13 ± 9.12 , with the youngest and oldest noted as 32 and 80, respectively (Table 2), while the mean FBS and PPBS values stood at 199.30 ± 72.71 and 317.44 ± 82.17 mg/dL with highest and lowest values recorded being 463; 70 mg/dL and 551; 147 mg/dL, respectively (Tables 3 and 4). The mean Hb (Table 5) and HbA1c (Table 6) values arrived at 11.77 ± 1.46 gm% and 8.73 ± 1.86 correspondingly with the maximal and minimal for these parameters noted as 15.6; 7 g% and 14.6; 6.6, respectively (Tables 5 and 6). The correlation analysis depicted a similar pattern as that of the general population with strong positive correlations between FBS, PPBS, and HbA1c (correlation coefficient values; 0.77, 0.77, and 0.79) but the age did not influence the blood sugar levels and HbA1c levels. The probability values for the samples at $P > 0.05$ was 0.001 for HbA1c, FBS, and PPBS, while for Hb, it was 0.17 and for age 0.71, this indicated the overall population's blood sugar levels and HbA1c probabilistically highly significant and can be matched and fitted with the diabetic cases of the general population. The hemoglobin levels and age were probably statistically insignificant.

DR has four stages. There were three in non-proliferative DR (NPDR) stage, (mild, moderate, and severe) and one in proliferative retinopathy. When 501 patients were assessed (Table 7), 5.6% among the total study population had an eye disease, Mild NPDR (Figure 1) in females was found among 10 and it was observed on eight males. Moderate NPDR (Figure 2) was identified in three males and two females, while no severe cases were reported among the men, two were noted among the women (Figure 3). One male patient was diagnosed with retinitis pigmentosa.

DISCUSSION

Type-2 DM has an extended pre-clinical asymptomatic phase. Hence, patients were exposed to the ill effects of asymptomatic hyperglycemia for a longer period before

Table 2: Age and sex distribution

Description	Numbers	Mean age in years	Highest age in years	Lowest age in years
Male	207	51.93 ± 10	82	32
Female	294	50.13 ± 9.12	80	32
Total	504	50.87 ± 9.54	82	32

Table 3: Gender wise FBS

Description	Numbers	Mean FBS (mg/dL)	Highest FBS (mg/dL)	Lowest FBS (mg/dL)
Male	207	199.79 ± 71.44	416	87
Female	294	199.30 ± 72.71	463	70
Total	504	199.50 ± 72.18	463	70

FBS: Fasting blood sugar

Table 4: Gender-wise PPBS

Description	Numbers	Mean PPBS (mg/dL)	Highest PPBS (mg/dL)	Lowest PPBS (mg/dL)
Male	207	328.58 ± 84.13	588	152
Female	294	317.44 ± 82.17	551	147
Total	504	322.04 ± 83.17	588	147

FBS: Fasting blood sugar

Table 5: Gender-wise Hb values

Description	Numbers	Mean Hb in g/dL	Highest Hb in g/dL	Lowest Hb in g/dL
Male	207	12.65 ± 1.42	17.3	8.0
Female	294	11.77 ± 1.46	15.6	7
Total	504	12.13 ± 1.51	17.3	7

FBS: Fasting blood sugar

Table 6: Gender-wise HbA1C

Description	Numbers	Mean HbA1C (%)	Highest HbA1C (%)	Lowest HbA1C (%)
Male	207	8.68 ± 1.75	14.9	6.8
Female	294	8.73 ± 1.86	14.6	6.6
Total	504	8.78 ± 1.82	14.9	6.6

they are diagnosed. The hyperglycemia that is present before diagnosis causes tissue damage resulting in complications of diabetes. Retinopathy is a specific and early complication that occurs in diabetes mellitus.⁷ The predominance of retinopathy accelerates abruptly when HbA1C surpasses 5.5% and FPG exceeded 105 mg/dL⁸ among the patients predisposed to DM. Longitudinal studies have shown the presence of retinopathy in normoglycemic people at the baseline, forecasting the advancement of diabetes which suggests some factors might impart in the pathogenesis of microvascular changes

Table 7: Comparison of diabetic retinopathy diabetic cases

Sex	Cases (%)	Mild NPDR (%)	Moderate NPDR (%)	Sever NPDR (%)	PR (%)
Male	207 (41.32)	8 (3.86)	3 (1.45)	0 (0)	1 (0.48)
Female	294 (58.68)	10 (3.4)	2 (0.7)	2 (0.68)	0 (0)
Total	501 (100)	18 (3.59)	5 (1)	2 (0.39)	1 (0.19)

NPDR: Non-proliferative diabetic retinopathy

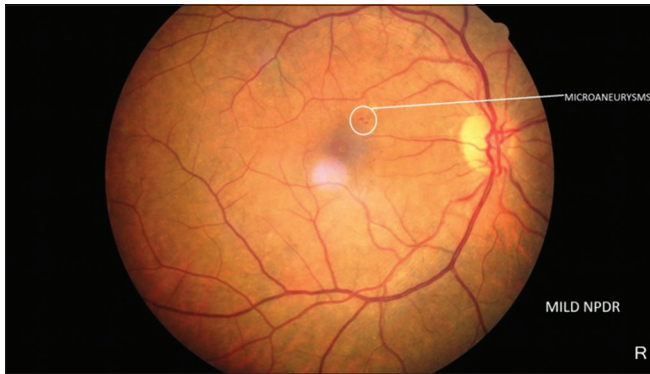


Figure 1: Mild non-proliferative diabetic retinopathy

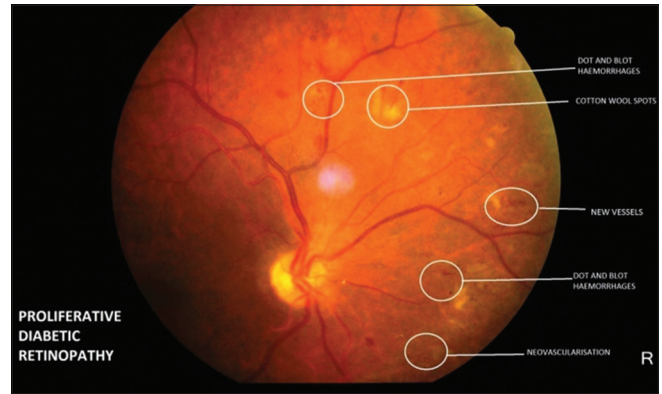


Figure 3: Proliferative diabetic retinopathy

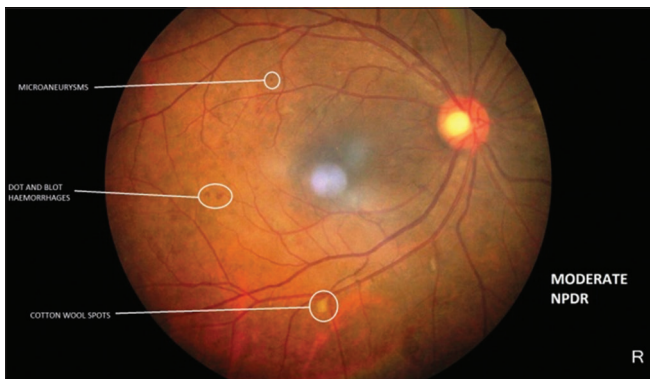


Figure 2: Moderate NPDR

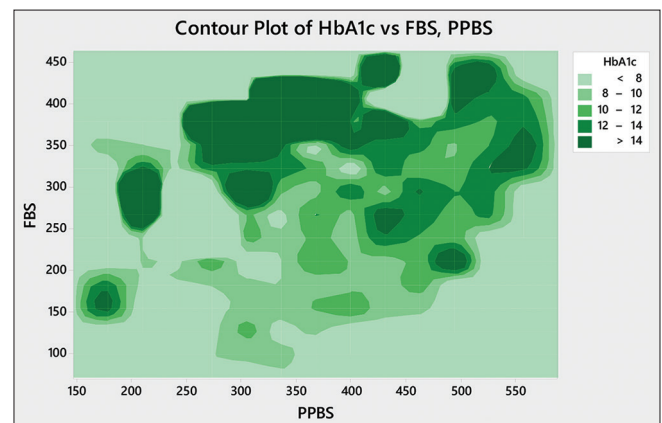


Figure 4: Interaction of study population's blood sugar levels on HbA1c

and diabetes.⁷ The prevalence of retinopathy is higher with longer duration of diabetes. The prevalence was found to be 12.5% in India.⁹ This is probably due to insufficient public awareness of DR as well as inadequate screening. Dietary pattern may also contribute to the difference of prevalence of diabetes and DR among countries which require further investigation.

This study outcome was in analogous with the report of Chennai Urban Rural Epidemiology Study (CURES) and CINDI study (Chronic Complications in Newly Diagnosed patients with Type 2 diabetes mellitus in India) these investigations established 5.1% and 6% prevalence of retinopathy in newly diagnosed Type 2 DM.^{3,10} The prevalence of DR variant in men and women was established in a study conducted by Jammal et al., (men 9.9% and women 4.3%).¹¹ Most of the studies in the literature observed no remarkable gender impact on the DR. The risk factors that were associated with the

development and progression of retinopathy besides hyperglycemia were hypertension and dyslipidemia.

To understand the impact of the blood sugar level of study population on HbA1c, a counterplot was constructed (Figure 4), which enables to elucidate the roles of these parameters on the response, so that this data can be easily extrapolated and fit with the general population to gauge the overall impact, which can also help to fit the data for DM-related complications like DR. A clinical study spanning over a period of 6 years in Japan involving 383 (M: F ratio of 1.78:1) with Type 2 diabetes mellitus portrayed that the women presented a significantly higher predominance in the development of DR and was established that the female gender was an independent risk factor for the development of DR.¹² A Similar study in 12 provinces in China showed female preponderance,¹³ but in our study, we

have not found any kind of greater correlation of gender toward DR.

CONCLUSION

The study highlights the prevalence of retinopathy in newly diagnosed Type 2 DM population in tertiary care center hospital in Salem district, Tamil Nadu, among those attended as an outpatient at GMKMCH. The occurrence of DR was in accordance with that of the national population data and statistics. Knowledge and information associated with diabetes and its ramification were predominately associated with the patient's attitude toward diabetes and timely diagnosis of retinopathy; besides the awareness of retinopathy was also relatively identified with good clinical practice. The study highlights the importance of detection of DM prior to the occurrence of complications which arise due to diabetes. Early detection of diabetes in the asymptomatic phase helps in the prevention of complications arising due to diabetes. Screening for microvascular complications is also necessary at diagnosis of DM.

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PG, KN, and KRM- Concept, Design and results interpretation, review of literature, and preparation of first draft of manuscript; VJA- Concept, design and results interpretation, review of literature, and revision of manuscript; and YT- Concept, design, results interpretation, review of literature, and final revision of manuscript.

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