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Original Research Article

A Study of Prevalence of Retinopathic Changes in Type 1 Diabetes Mellitus

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ABSTRACT

Background
Diabetes, a prevalent metabolic disorder, has become a significant global health concern. In Type 1 diabetes, diabetic retinopathy stands out as a leading cause of blindness, with its occurrence influenced by the severity and duration of diabetes.

Methods
This research was conducted at the Department of Ophthalmology, Regional Eye Hospital, Kurnool, spanning from November 2019 to October 2021. The study encompassed both outpatient attendees and referrals from other departments, involving a total of 100 patients screened for diabetic retinopathy. Comprehensive assessments, including visual acuity testing for each eye, pinhole correction, and vision improvement with glasses, were conducted. Additional evaluations comprised slit lamp examinations for anterior segment assessment, intraocular measurement via Goldman applanation tonometry, torchlight pupillary reactions to rule out relative afferent pupillary reaction, and dilatation of pupils with Tropicamide eye drops for detailed fundus examination using both direct and indirect ophthalmoscopes and a 90 D Lens. Optical coherence tomography (OCT) was employed in cases exhibiting fundus abnormalities such as clinically significant macular edema. Fundus fluorescein angiography was conducted to assess capillary perfusion, with ultrasound B scans performed in cases of hazy media to exclude posterior segment pathology.

Results
Among the 100 patients in the study, 68% were male, compared to 32% female, with the highest prevalence observed in the age group of 11-30 years. Of the participants, 76% exhibited normal findings without diabetic retinopathy, while 24% displayed retinopathy changes. Many patients

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(86%) were on oral medication, 8% received insulin injections, and the remaining 6% utilized a combination of insulin and oral medication.

Conclusion

Diabetic retinopathy affects the microvasculature of the retina. Given that diabetes impacts 4% of the global population, nearly half of whom experience some degree of retinopathy changes, regular follow-ups with both physicians and ophthalmologists, particularly during puberty, are of paramount importance.

Keywords: Type 1 Diabetes, Diabetic Retinopathy, Hba1c Frequent Follow Up.

INTRODUCTION

India has a notable number of individuals with diabetes, earning it the label of the "diabetes capital of the world." According to the International Diabetes Federation's Diabetes Atlas 2006, the current diabetic population in India is approximately 61 million, and it is expected to reach 100 million by 2030 unless immediate preventive measures are taken. The World Health Organization's VISION 2020 campaign is working to address various eye conditions, including diabetic retinopathy.[1]

Diabetic retinopathy is a specific focus of the World Health Organization's VISION 2020 initiative and is a significant contributor to preventable blindness in both developed and developing countries. Diabetics face a 20-25 times higher likelihood of blindness.[2] compared to the general population. Roughly half of individuals with very severe non-proliferative diabetic retinopathy (NPDR) progress to proliferative diabetic retinopathy (PDR) within a year in the natural course of the disease.

Given the public health concern posed by diabetes in India, understanding the prevalence of diabetic retinopathy is vital for shaping primary and secondary prevention efforts. The present study aims to determine the prevalence of diabetic retinopathy specifically in type-1 diabetic patients.

MATERIALS AND METHODS

The present study was carried out at the Department of Ophthalmology, at Regional Eye Hospital, Kurnool, Andhra Pradesh. It was a cross sectional study conducted over a period of two years from November 2019- October 2021. Type-1 Diabetic patients who were attending the outpatient department and referred to from other departments were included in the study. A total of 100 patients were screened for Diabetic retinopathy.

Inclusion Criteria

Patients with type 1 diabetes mellitus with age of onset <30 years.

Exclusion Criteria

1. Age at onset >30 years
2. Ocular disease due to any other cause.
3. Any history of ocular surgery/trauma.
4. Other systemic diseases that can affect retina or vision.

The Ophthalmic Examination Includes

- Visual acuity and refraction.
- Slit lamp examination.
- 90 D Slit lamp bio-microscopy to evaluate fundus.
- Direct / Indirect ophthalmoscopy.

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- Fundus photography

Laboratory Examinations

Investigations were done at the Government General Hospital, Kurnool laboratory and included the following.

1. Blood sugar levels
2. Urine sugars
3. Hba1c – Glycosylated Haemoglobin.

The American Diabetic Association criteria were used to categorize blood sugar levels, with HbA1c >6.5 percent being considered abnormal.

Statistical Analysis

The excel and SPSS (version 23,) software packages were used for data entry and analysis. The results were averaged.

Numbers and proportions for categorical data presented in table and figure. Proportions were compared using chi-square test of significance with yates corrections.

In the entire above test, a "p" value of less than 0.05 was accepted as indicating statistical significance.

RESULTS

A total of 100 patients were included in the study.

As shown in table 1, out of 100 patients screened for diabetic retinopathy, 76 (76%) were normal without retinopathy changes. 24 (24%) had fundus changes of retinopathy. Thus, the prevalence of retinopathy among Type 1 diabetes mellitus was 24%.

Type of DR	Frequency	Percent
Normal	76	76%
Mild NPDR	8	8%
Moderate NPDR	6	6%
Severe NPDR	3	3%
Very Severe NPDR	3	3%
Early PDR	2	2%
High risk PDR	2	2%
Total	100	100%

Table 1: Prevalence of Diabetic Retinopathy

In the present study as shown in table 2, the frequency of type 1 diabetes mellitus was highest among the age group of 16-20 years, which was 60%.

	Frequency	Percent
11 – 15	14	14%
16 – 20	60	60%
21 – 25	20	20%
26 – 30	6	6%
Total	100	100%

Table 2: Age distribution of patients

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In the present study as shown in table 3, retinopathy changes were mostly seen in the age group of 16-30 years. Therefore, the grade of retinopathy was statistically significant to age incidence. p value<=0.0001.

	Grade of Retinopathy						
Age	**Normal**	**Mild NPDR**	**Moderate NPDR**	**Severe NPDR**	**Very Severe NPDR**	**Early PDR**	**High Risk PDR**
11 – 15	14	0	0	0	0	0	0
16 – 20	56	2	1	0	0	1	0
21 – 25	6	6	4	1	1	0	2
26 – 30	0	0	1	2	2	1	0
TOTAL	76	8	6	3	3	2	2
Chi square test = 86.006 , p=<0.0001*, Statistically significant							

Table 3: Age distribution of grade of retinopathy

In the present study as shown in table 4, the mean age in patients with retinopathy changes was higher than the normal patients without retinopathy changes. Therefore, grade of retinopathy was statistically significant to mean age, p value=<0.001.

Grade of Retinopathy	**Age in Mean ± SD**
Normal	17.52 ±2.28
Mild NPDR	21.50 ±1.77
Moderate NPDR	22.16 ± 0.98
Severe NPDR	26.66 ±3.05
Very Severe NPDR	26 ± 4.58
Early PDR	28 ± 0.21
High risk PDR	25 ± 2.82
F value = 29.75, p=<0.001*, Statistically significant	

Table 4: Mean age of grade of retinopathy

As shown in table 5, there were 68 male (68%) and 32 female (32%) among the 100 type 1 diabetic patients. Thus, male patients were more than females in our study.

Gender	**Frequency**	**Percentage**
Male	68	68%
Female	32	32%
Total	100	100%

Table 5: Gender distribution of patients

As shown in table 6, In the present study, among male mild retinopathy changes were more seen. Among females moderate retinopathy changes were more seen. Therefore, grade of retinopathy was not statistically significant to gender wise incidence p value =0.33.

	Grade of Retinopathy						
Gender	**Normal**	**Mild NPDR**	**Moderate NPDR**	**Severe NPDR**	**Very Severe NPDR**	**Early PDR**	**High Risk PDR**
Male	54	6	3	2	2	0	1
Female	22	1	3	1	1	2	1
Total	76	8	6	3	3	2	2
Chi square test = 5.67, p=0.33, Not Statistically significant							

Table 6: Gender distribution of grade of retinopathy

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As shown in table 7, in the present study, the mean duration of diabetes was 6.42±3.08.

Duration in Years	Frequency	Percentage
<5	48	48%
6 – 10	40	40%
11 – 15	12	12%
Total	100	100%
Mean ± SD	6.42 ± 3.08	

Table 7: Mean Duration of Diabetes

As shown in table 8, in the present study, we found that as duration of diabetes increased severity of retinopathy also increased. There was a statistical significance in prevalence of diabetic retinopathy and duration of disease p<0.0001.

	Grade of Retinopathy						
Duration in Years	Normal	Mild NPDR	Moderate NPDR	Severe NPDR	Very Severe NPDR	Early PDR	High Risk PDR
<5	48	0	0	0	0	0	0
6 – 10	28	8	2	0	0	1	1
11 – 15	0	0	4	3	3	1	1
TOTAL	76	8	6	3	3	2	2
Chi square test = 91.13, p=<0.0001*, Statistically significant							

Table 8: Association between duration of diabetes and Grade of retinopathy

DISCUSSION

Diabetes has become a significant global health concern, with diabetic retinopathy being the leading cause of blindness in the working-age population. The prevalence of both type 1 and type 2 diabetes is increasing among children and adolescents worldwide. Diabetic retinopathy, a consequence of diabetes, is often asymptomatic in its early stages but can progress to blindness.[3] In juveniles with type 1 diabetes, the risk of diabetic retinopathy is influenced by disease duration and puberty timing.

Various clinical practice guidelines exist for ophthalmic screening in children and adolescents with type 1 diabetes,[4] although there is disagreement among medical professional societies regarding monitoring recommendations. For those aged 10 years or older, the American Diabetes Association recommends the first screening 3 to 5 years from diabetes onset, while the American Academy of Pediatrics suggests the same for patients aged 9 and older. A recent study proposed that delaying initial ophthalmic screening until the age of 15 is acceptable. All guidelines emphasize optimizing diabetes control, measured by glycated hemoglobin A1c fraction (HbA1c).

Diabetes affects around 2% of the world population, with 10-15% being type 1 and the rest type 2. As the global prevalence of diabetes continues to rise, diabetic retinopathy remains a leading cause of vision loss in many countries, affecting approximately 20% of people with diabetes.[5] The condition develops in over 75% of diabetic patients within 15-20 years of diabetes diagnosis.[6] The worldwide prevalence of diabetes is estimated to reach 360 million by 2030[7] with over 85% of diabetic patients residing in developing countries. In India alone, the prevalence of diabetes is expected to increase from 41.7 million in 2000 to 79.4 million in 2030.

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A 2000 national survey in India revealed a 12.1%[8] prevalence of diabetes in urban Indian adults. Diabetes onset in Indians occurs approximately a decade earlier than in Western counterparts, and 54.1% of diabetics develop the condition before the age of 50, facing a higher risk of chronic complications. The Aravind Comprehensive Eye Study reported a 10.5% prevalence of diabetic retinopathy in rural South India.[9]

Diabetic retinopathy is a progressive condition characterized by microvascular changes leading to retinal issues. Factors such as the duration and type of diabetes, blood sugar control, systemic conditions, age, and sex are associated with retinopathy and its progression.[10] In India, with the increasing prevalence of type 2 diabetes, diabetic retinopathy is emerging as a significant cause of visual disability, posing a preventable and treatable public health challenge. Early intervention can preserve the quality of life for individuals with diabetes. The present hospital-based study aimed to estimate the prevalence of diabetic retinopathy among type 1 diabetes mellitus patients, screening 100 individuals with various methods. The study found a higher prevalence in males (68%) than females (32%), with ages ranging from 11 to 30 years. Most patients with diabetic retinopathy had a diabetes duration of 6-15 years. Most patients (86%) were on oral medication, while 8% were on insulin, and 6% used a combination of insulin and oral medication. While 79.1% had good visual acuity, 20.9% exhibited severe visual impairment due to diabetic retinopathy.

SUMMARY

The study included 100 patients with type 1 diabetes mellitus, with 68% being males and 32% females. The age range of the patients was 11-30 years. The prevalence of diabetic retinopathy in the study was found to be 24%, with 76% showing no retinopathy changes. Non-proliferative diabetic retinopathy was observed in 20%, while proliferative diabetic retinopathy was found in 4%. Approximately 16.6% of patients had diabetic retinopathy with CSME. Among those with diabetic retinopathy, 79.1% had good vision, and 20.9% had severe visual impairment. In terms of treatment, 86% of patients with type 1 diabetes were on oral hypoglycemic agents (OHA), 8% were on insulin, and 6% were on both OHA and insulin. The study indicated that patients using both OHA and insulin had higher rates of retinopathy changes compared to those using only insulin or OHA. There was a notable correlation between the duration of diabetes and the severity of retinopathy. Patients with a duration of type 1 diabetes less than 5 years showed no retinopathy changes, while those with a duration of 6-15 years exhibited retinopathy changes. The findings suggest that the longer the duration of diabetes, the higher the severity of retinopathy. Additionally, as blood sugar levels, urine sugar levels, and HbA1c levels increased, the severity of retinopathy also showed an upward trend.

CONCLUSION

In this study, the prevalence of diabetic retinopathy among type 1 diabetes mellitus patients was found to be 24%. The duration of diabetes was strongly associated with retinopathy changes, indicating that the longer the duration, the higher the severity of retinopathy. Risk factors such as random blood sugars, urine sugar levels, and HbA1c levels were identified, and an increase in these levels was correlated with an increase in retinopathy severity.

Considering the direct relationship between retinopathy changes and the age of the diabetic patient, it is recommended to implement regular screening programs to detect retinopathy changes in the early stages. This approach facilitates the education of patients about the adverse effects and consequences of diabetic retinopathy progression. It is advisable for all type 1 diabetes mellitus patients attending the hospital to undergo screening for retinopathy, and awareness programs to the public can help achieve this goal. Additionally, maintaining balanced diabetes and ensuring

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regular ophthalmologic follow-up for diabetic children, especially during puberty, are crucial aspects.

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