Original Article

Clinical Analysis of Diabetic Retinopathy in Type 2 Diabetic Patients and its Correlations with Biochemical Parameters

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Abstract

Introduction: Diabetic retinopathy, a microvascular complication of diabetes is one of the major tragedies in ophthalmology. It still remains among the leading cause of preventable blindness in the developing and developed worlds.

Aim: To correlate the metabolic changes with clinical manifestations of diabetic retinopathy.

Materials and Methods: A total of 55 diabetic patients between the age group of 40 and 70 years who attended ophthalmology OP of Government Vellore Medical College from April 2016 to April 2017 were included in the study. We recorded all their biochemical parameters, and detailed ophthalmic examination was done. The data were analyzed statistically by simple proportion

Results: Out of the 55 patients 35 patients had retinopathy and was found to be more in males and the age group of 40-60 years. Patients with high mean fasting blood sugar levels had a higher incidence of retinopathy. Similarly, patients with high glycosylated hemoglobin (HbA1c) had a higher risk of retinopathy. Patients with low mean total protein level and cholesterol levels above the normal values had a higher risk of retinopathy.

Conclusion: This study shows a male preponderance and the most common age group being 40-60 years. Of all the parameters, poor metabolic control of diabetes as evidenced by a high fasting blood sugar and a high HbA1c along with hyperlipidemia are the significant changes which can precipitate diabetic retinopathy.

Key words: Biochemical parameters, Diabetic retinopathy, Type 2 diabetes

INTRODUCTION

Diabetes mellitus is one of the common medical problems in the developing and developed world.

Fundamentally, diabetes mellitus is an abnormality of blood glucose metabolism due to altered insulin production or activity, clinically manifested by elevated blood levels of glucose in the blood. Diabetes mellitus causes numerous long-term systemic complications that have considerable associated morbidity.

Diabetic retinopathy, a retino-vascular complication of diabetes is one of the major tragedies of the ophthalmology in our present generation, always common and rapidly becoming still more common affecting the young as well as the aged predictable but not preventable and relatively untreatable chronic and progressive in its course, remains leading cause of blindness in the developing world.

Historical Review

The history of diabetes is as old as medicine. Susrutha in Indian medicine described diabetes as "honey urine." Specific changes in ocular fundi were first described by Van Jaefer (1856) and later elaborated by Hirscherg (1890-91). Recent works have shown both clinically and histologically that retinopathy in diabetes is characteristic of that disease depending on the alteration in the walls of the capillaries accompanied by deposition of hyaline from which the typical appearance of microaneurysm hemorrhages and exudates results which mimic renal glomerular changes.[1]

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MATERIALS AND METHODS

A total of 55 diabetic patients within the age group of 40-70 years were included in the study.

A careful history was elicited from the patients regarding the duration of diabetes, diabetic control, and treatment. A thorough ophthalmic examination was done which included visual acuity measurement by Snellen's chart, slit lamp examination to evaluate the anterior segment and fundus examination by indirect ophthalmoscopy, and slit lamp by microscopy. The following investigations were carried out in all patients:
1. Fasting blood sugar
2. Glycosylated hemoglobin (HbA1c)
3. Serum protein
4. Serum cholesterol
5. High-density lipoprotein cholesterol
6. Triglycerides
7. Low-density lipoproteins (LDLs).

RESULTS AND DISCUSSION

In this study, 55 visually symptomatic Type 2 diabetic individuals who attended Ophthalmology Department of Government Vellore Medical College from April 2016 to April 2017 were chosen. Type 1 diabetic patients were excluded from the study. Patients with diabetic nephropathy or any systemic illness were not included in the study.

Prevalence
Out of the 55 cases, 35 cases had retinopathy which shows a prevalence of 64%, may be taken as a prevalence of diabetic retinopathy in visually symptomatic individuals of Type 2 diabetes (Table 1).

Age Group
In this study, we found that the incidence of diabetic retinopathy is widely prevalent in the age group of 40-60 years. Risk of blindness increases with age of the patient (Table 2).

It was found that the incidence of diabetic retinopathy is more in males compared to females. In the WEDSR, UKPDS and other studies conducted men were found to be affected more when compared to women (Table 3).[2]

Clinical Presentation
Among the 35 cases of diabetic retinopathy taken for study 18 of them had nonproliferative diabetic retinopathy (PDR) both severe and mild and 17 of them had proliferative diabetic retinopathy PDR. Among these 35 patients, 13 had maculopathy. All these diagnosis were confirmed after doing fundus fluorescein angiography (FFA). In FFA, 11 patients had an increase in foveal avascular zones, 16 patients had increased capillary drop out, and 12 patients had neovascularization over the disc, and 5 patients had neovascularization elsewhere (Table 4).

Biochemical Parameters
Fasting blood sugar
In diabetics without retinopathy, the mean fasting blood sugar level is 155.75 mg%. In diabetic retinopathy, the mean fasting blood sugar level is 204.97 mg%. This is statistically highly significant, P value being <0.05. This study proves that raised fasting blood sugar is an important determinant factor in occurrence of retinopathy. This study also correlates with similar studies conducted by Jackson *et al.* 1970, Hardin *et al.* 1956. The study was done by Pirart *et al.* also is in favor of good control (Table 5).[3]

Table 1: Prevalence

Total number of cases	Diabetes without retinopathy	Diabetes with retinopathy
55	20	35

Table 2: Age group

Age group	Number of cases (%)
<40 years	3 (8)
40-60 years	41 (76)
60 years	11 (16)

Table 3: Sex ratio of diabetic retinopathy

Sex	Number of cases (%)
Male	29 (52)
Female	26 (48)

Table 4: Clinical presentation

Diabetic retinopathy	Number of cases (%)
NPDR-mild	10 (28)
NPDR-severe	8 (22)
PDR	17 (50)

NPDR: Nonproliferative diabetic retinopathy, PDR: Proliferative diabetic retinopathy

Table 5: Fasting blood sugar

Mean	Diabetes with retinopathy	Diabetes without retinopathy
Mean±standard deviation	204.97±96.19	155.75±62.58
P value	<0.05 significant	

HbA1c

The purpose of assessing the HbA1c is to have an idea about control of diabetes. In this study, the mean HbA1c level of the control group is 5.28% ranging from 4% to 8.5% in diabetes without retinopathy the mean HbA1c level is 8.19% ranging from 5% to 12.6%. In diabetic retinopathy, the mean HbA1c level is 7.61% ranging from 6% to 10.41%. Similar findings were found with studies by Kein *et al.* (1984), Gray *et al.* (1982) and Rand *et al.* (1984), and Nakayoshi *et al.* (1983).

In the WESDR – persons with poorer metabolic control as measured by higher HbA1c were found to be at a greater risk of having more frequent or severe retinopathy. Similar findings were noted by Krowlewki *et al.* Studies of twins suggest that increase HbA1c is not genetically determined but instead to the metabolic derangements. These studies indicate that to prevent hypoxic microvascular responses and in time, diabetic retinopathy it is necessary to regulate diabetes optimally by insulin, diet, and exercises to secure normoglycemia for as long periods as possible. This should decrease the formation of HbA1c in red cells. Regulation will also tend to increase level of plasma inorganic phosphate and formation of red cell 2-3 diphosphoglycerate (Table 6).[4]

Protein fractions

In diabetes without retinopathy, the mean total protein level is 6.735 g/100 ml. In diabetic retinopathy, it is 5.94 g/100 ml. There is a slight decrease the total protein value of diabetic retinopathy individuals when compared to those without retinopathy. This correlates with the study of Ditzel and Moniat who had established increased red blood cell aggregation due to the increase of fibrinogen and alpha-2 globulin with associated reduction of serum albumin and thereby lowering of the total protein level. Changes in serum proteins, lipoproteins, and protein bound carbohydrates in relation to pathologic alterations in the microcirculation of diabetic subjects (Table 7).[5]

Lipid profile

The total cholesterol levels in patients with retinopathy are 212 mg% and in patients without retinopathy are 206.55 mg% (Table 8).

With the above values, we can come to the conclusion that those with high cholesterol levels have 4 times higher risk of developing retinopathy. It shows that 68.2% of diabetic individuals with retinopathy have elevated cholesterol. This agrees with the previous studies which have shown generalized hypercholesterolemia, hypertriglyceridemia, and increase in LDLs in diabetics. Dornan *et al.* (1982) found PDR associated with raised cholesterol almost due

Table 6: HbA1c

Mean	Diabetes without retinopathy	Diabetic retinopathy
Mean±standard deviation	8.19±2.37	7.62±1.60

HbA1c: Glycosylated hemoglobin

Table 7: Total protein

Patients	Total protein
Diabetes without retinopathy	6.735
Diabetes with retinopathy	5.94

Table 8: Lipid profile

Patients	Total cholesterol	HDL	TGL	LDL
Retinopathy	212	40.97	165.24	138.3
No retinopathy	206.55	42.08	155.15	127.97

HDL: High-density lipoprotein, TGL: Triglyceride level, LDL: Low-density lipoprotein

to elevated LDL entirely. Mohan *et al.* (1984) studied Indian non-insulin dependent diabetes in Madras patients with diabetic maculopathy had higher cholesterol, especially LDL.

CONCLUSION

This study was conducted in a tertiary hospital in South India, and it shows male preponderance and most common age group of 40-60 years in this study the mean fasting blood sugar level was high which shows that increased fasting blood sugar level is an important determinant factor in the occurrence diabetic retinopathy. Cases with poor metabolic control measured by higher HbA1c were found to be at greater risk of having more frequent or severe retinopathy. A decrease in protein levels was found in patients with diabetic retinopathy. There were hypercholesterolemia and hypertriglyceridemia and a mild increase in LDLs in this study thereby showing that these changes do seem to play a major role in the development of retinopathy.

Diabetic retinopathy is an important devastating consequence of diabetes and a common cause of blindness in the developing and developed countries. Hence, early screening, regular follow-up and a good control of diabetes along with dietary habits and exercise can go a long way in the prevention of blindness due to diabetes.

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