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STUDY THE CORRELATION BETWEEN SEVERITY OF DIABETIC RETINOPATHY WITH CONTROL AND DURATION OF DIABETES

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ABSTRACT: BACKGROUND: The purpose of this study was to study the correlation between severities of Diabetic Retinopathy with control and duration of diabetes. Methods: 1200 diabetic patients attending the eye OPD of Safdarjung Hospital between 2008 to 2010 were screened for diabetic retinopathy. The control of diabetes was monitored using glycosylated hemoglobin level. Their duration of diabetes was noted. **RESULTS:** Patients with uncontrolled diabetes developed Diabetic Retinopathy 23.32 times more compared with controlled groups. 82.18% of controlled diabetics had no retinopathy compared to 16.51% of uncontrolled diabetics. Occurrence of moderate and severe Retinopathy was significantly higher in uncontrolled diabetics, 43.12% and 20.64%, respectively as compared with 5.29% and 2.14% in controlled diabetics. All 10 cases of proliferative retinopathy were found in uncontrolled diabetics. Only 21.69% of patients having diabetes for 0-5 years developed retinopathy compared with 58.82% of patients having the diabetes for 20 years or more. It was shown that for every 5 years increase in the duration of diabetes, the risk for retinopathy increased 1.57- fold. Also the retinopathy severity increased with increasing duration. **CONCLUSION:** Statistical methods concluded that Retinopathy was more likely to occur and with more severity in uncontrolled than controlled diabetics. Also Retinopathy was more likely to occur as the duration of diabetes increased.

KEYWORDS: Diabetic Retinopathy.

INTRODUCTION: Diabetic retinopathy is emerging as one of the important causes of blindness in both developing and developed countries. The World Health Organization (WHO) has estimated that, the number of adults with diabetes in the world would increase alarmingly: from 135 millions in 1995 to 300 millions in 2025. This increase is expected to be the greatest in India nearly 195% from 18 million in 1995 to 54 million in 2025.²

An epidemiological study was undertaken keeping in mind paucity of such study in North Indian population. Study was carried out from 2008 to 2010 at Safdarjung Hospital and VMMC, New Delhi.

MATERIALS AND METHODS: The study was conducted in Department of Ophthalmology and Medicine, Safdarjung Hospital, New Delhi. A total of 1200 patients with diabetes mellitus (no distinction made as to type of Diabetes-both type 1 and 2 included in study) attending the Diabetic Clinic in Medicine and Retina Clinic in Ophthalmology were enrolled in the study.

Out of 1200 patients 598(49.8%) were Females and 602(50.2%) were males. Mean age of a patient enrolled in study was 51.98 yrs with 27 being the minimum and 86 being the maximum age.

Patients were classified into controlled and uncontrolled diabetics based on levels of glycosylated hemoglobin (hemoglobin A1c controlled below 6.0% without hypoglycemia and below

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7.0% for rest) and or plasma glucose levels (level for control 70-130 mg/dl, or 3.9-7.2 mmol/L).

Diabetic Retinopathy was noted to be either present or absent. If present, it was classified into Non-proliferative (further classified into mild, moderate or severe) or proliferative (further classified into Early or High-risk type) as per definition.

Following classification was used:

- A. Mild Non-proliferative diabetic retinopathy: Presence of at least one microaneurysm.
- B. Moderate Non-proliferative diabetic retinopathy:
 1. Presence of hemorrhages, micro aneurysms and hard exudates
 2. Soft exudates, venous beading and IRMAs less than that of severe NPDR.
- C. Severe Non-proliferative diabetic retinopathy:
 1. Hemorrhages and micro aneurysms in all four quadrants
 2. Venous beading in at least two quadrants.
 3. IRMA in at least one quadrant.
- D. Proliferative diabetic retinopathy: Included following features:
 - Neovascularisation.
 - Pre-retinal or vitreous hemorrhage.
 - Fibro vascular tissue proliferation associated with neovascular complex.
 - Tractional retinal detachment.

Proliferative diabetic retinopathy was classified into:

1. Early/Low risk proliferative diabetic retinopathy - presence of new vessels but not meeting criteria for high risk Proliferative diabetic retinopathy.
2. High risk proliferative diabetic retinopathy:
 - A. Neovascularisation of disc > 1/3 to ½ of disc area.
 - B. Any amount of neovascularisation with vitreous or pre-retinal or hemorrhage.
 - C. Neovascularisation outside the disc greater than or equal to half disc area with pre-retinal or vitreous hemorrhage.

Also noted was clinically significant macular edema, which is defined as anyone of the following:

- A. Retinal thickening located 500µm or less from center of foveal avascular zone.
- B. Hard exudates with retinal thickening 500µm or less from center of foveal avascular zone.
- C. Retinal thickening one disc area or larger in size located within one disc area of foveal avascular zone.

Duration of Diabetes was noted as per history given by the patients.

RESULTS: The 1200 patients enrolled in the study were divided into two groups (table 1). The presence of Diabetic Retinopathy in both the groups was noted (table 2, 3, 4 figure 1, 2, 3, 4).

Pearson's Chi-Square test was applied and patients with uncontrolled Diabetes were found to be at a statistically significant ($p=0.000$ i.e. <0.05) greater risk of developing Diabetic Retinopathy compared with those having controlled Diabetes.

An Odd's ratio of 23.32 also showed that uncontrolled Diabetics have 23.32 times more risk of developing retinopathy than controlled Diabetics.

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Pearson Chi-Square test and Likelihood ratio ($p=0.000$ i.e. <0.05) both showed that uncontrolled diabetics are more likely to develop more severe form of Diabetic Retinopathy as compared to controlled diabetics.

Out of 982 controlled Diabetics 807 had no retinopathy i.e. 82.18% of controlled Diabetics had no retinopathy compared to just 16.51% of uncontrolled Diabetics who had no retinopathy (36 out of 218 cases).

The occurrence of mild Diabetic Retinopathy was comparable in uncontrolled Diabetics (11.87%, 33 out of 218 cases) with controlled Diabetics (10.39%, 102 out of 982 cases).

Occurrence of moderate and severe Diabetic Retinopathy was significantly higher in uncontrolled Diabetics, 43.12% and 20.64%, respectively as compared with 5.29% and 2.14% in controlled Diabetics.

All 10 cases of proliferative retinopathy were found in uncontrolled Diabetics. Chi-Square test was applied and it was observed that the occurrence of Diabetic Retinopathy increased with increased duration of disease ($p=0.000$ i.e. <0.05).

Only 21.69% of patients having diabetes for 0-5 years developed retinopathy compared with 58.82% of patients who developed Diabetic Retinopathy after having the diabetes for 20 years or more.(figure6)

A statistically significant risk of developing a more severe form of diabetic retinopathy was shown to exist as the duration of diabetes increased ($p=0.000$ i.e. <0.05 using Chi- Square test).

Logistic regression analysis showed that for every 5-year increase in the duration of diabetes, the risk for DR increased 1.57-fold.

Percentage of patients having severe Diabetic Retinopathy was significantly more in patients having duration of disease as 20 years or more (11.76%) and 15-20 years(15.63%) as compared to groups with duration of diabetes 0-5 years(5.8%), 5-10 years(3.49%) and 10-15 years(5.34%). (figure 6, 7, 8, 9, 10).

Mild Diabetic retinopathy was also found more in the groups 10-15 years (16.5%), 15-20 years (34.38%) and 20+ years(47.06%) as compared with groups 0-5 years (5.36%) and 5-10 years (8.84%). (Table5 and figure 5a and 5b).

Occurrence of moderate Diabetic Retinopathy was 20% in group 10-15 years as compared with 9.32% in group 0-5 years and 12.96% in group 5-10 years. (Table5 and figure 5a and 5b).

DISCUSSION: Diabetic retinopathy is a leading cause of blindness amongst the working class (<55 years old) in the industrialized countries. The emerging scenario in the developing world suggests that diabetes and blindness secondary to diabetic retinopathy may soon be a major problem in this part of the world as well. Unfortunately, India has no figures for diabetic retinopathy as a cause for blindness as no proper survey has been carried out as yet. Our blindness figures still rest on the decade-old National Programme for Control of Blindness survey carried out in the mid-eighties.

It has been reported in the literature from the developed world that 20 years after the onset of diabetes, nearly all patients with type I diabetes and more than 60% of those with type II diabetes will have some degree of retinopathy. However, this also depends on the degree of metabolic control of diabetes.

Studies done by the ICMR in the early 1970's had shown the prevalence of diabetes in India to be 2.5% in the urban population and 1.5% in the rural population. However recent reports have

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shown the prevalence to be in the range of 12 to 14% in the urban population. Of these patients with diabetes, over 20% are expected to be suffering from diabetic retinopathy. The prevalence of diabetes in the rural population is expected to be about 5%.

It is established that screening for diabetic retinopathy saves vision at a relatively low cost, and this cost is many times less than the disability payments provided to people who go blind in the absence of a screening program.

As per studies diabetic retinopathy is the most common cause of preventable blindness between 30 to 65 years of age.

Though no studies are available showing correlation of Diabetic retinopathy with control of Diabetes in North Indian Population few international and studies done in south India are available.

A study done by Rema et al.³ showed that for every 2% elevation of glycated hemoglobin (HbA1c), the risk for DR increased by a factor of 1.7.

In a study Pradeepa et al.⁴ revealed that male gender, duration of diabetes, glycated hemoglobin, macro albuminuria and insulin therapy were significantly associated with severity of DR. The risk for developing DR was 7.7 times for elevated postprandial plasma glucose levels compared with 4.2 times for elevated fasting plasma glucose.⁴

This can be compared with our study in which Odd's ratio of 23.32 also shows that uncontrolled Diabetics have 23.32 times more risk of developing retinopathy than controlled Diabetics.

Other studies with which the findings of our study can be compared are Rajala et al.⁷ found the that the prevalence of retinopathy was 10.2% (95% CI 4.8-18.5) in subjects with a fasting blood glucose of ≥ 6.1 mmol/l, while it was 2.6% (1.5-4.0) in those with a lower fasting blood glucose level and study done by McKay et al.⁹ which found out that retinopathy was positively associated with a longer reported duration of diabetes diagnosis and with higher fractions of glycosylated hemoglobin.

It was found that only 21.69% of patients having diabetes for 0-5years developed retinopathy compared with 58.82% of patients who developed Diabetic Retinopathy after having the diabetes for 20 years or more.

This is further backed by literature from the developed world that 20 years after the onset of diabetes, nearly all patients with type I diabetes and more than 60% of those with type II diabetes will have some degree of retinopathy.¹

Our study concluded that more the duration of diabetes the more likely that patient will have retinopathy and more would be its severity. Logistic regression analysis showed that for every 5-year increase in the duration of diabetes, the risk for DR increased 1.57-fold.

This was comparable with study of Rema et al.³ logistic regression analysis in which showed that for every 5-year increase in the duration of diabetes, the risk for DR increased 1.89-fold. Our findings are further backed by McKay et al.⁹

Who found retinopathy was positively associated with a longer reported duration of diabetes diagnosis and by Cahill et al.¹⁰ who in his study found out that patients with DR had a significantly higher median duration of diabetes (5.0 years) compared with those patients without DR (3.5 years).

The need of the hour is therefore to control diabetes with appropriate treatment as early as possible to prevent the occurrence of one of diabetes important micro vascular complication which is diabetic retinopathy. Patients with longer duration of diabetes require appropriate treatment and

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regular examination to prevent and detect retinopathy at the earliest so that morbidity related to it can be avoided and or managed at the earliest and in the most appropriate way.

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DIABETES	NUMBER OF PATIENTS
UNCONTROLLED	218
CONTROLLED	982
Table 1	

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Figure 1: Showing Controlled and uncontrolled diabetics

DIABETES	Retinopathy Present	Retinopathy Absent	Total
UNCONTROLLED	182	36	218
CONTROLLED	175	807	982
TOTAL	357	843	1200

Table 2

Figure 2: Showing Diabetic retinopathy prevalence

Diabetes	No DR	Mild DR	Moderate DR	Severe DR	PDR	Total
Uncontrolled	36(3%)	33(2.75%)	94(7.83%)	45(3.75%)	10(0.83%)	218
Controlled	807(68.25%)	102(8.5%)	52(4.33%)	21(1.75%)	0(0%)	982
Total	843	135	146	66	10	1200

Table 3: The following were the findings of severity of Diabetic Retinopathy in controlled and uncontrolled diabetics.

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Duration of Diabetes	Retinopathy Absent	Retinopathy Present (a)	Total (b)	% of patients developing DR (a/b x100)
0-5 years	336	93	429	21.69
5-10 years	363	123	486	25.30
10-15 years	103	84	187	44.92
15-20 years	27	37	64	57.81
20 years or more	14	20	34	58.82
Total	843	357	1200	

Table 4: The 1200 patients enrolled in the study were divided into five groups

Duration of Diabetes	No DR	Mild DR	Moderate DR	Severe DR	PDR	Total
0-5 years	336	23	40	25	5	429
5-10 years	363	43	63	17	0	486
10-15 years	103	31	38	10	5	187
15-20 years	27	22	5	10	0	64
20 years or more	14	16	0	4	0	34
Total	843	135	146	66	10	1200

Table 5: The following were the findings of severity of Diabetic Retinopathy in relation to duration of disease

Figure 1: Showing Controlled and uncontrolled diabetics

Figure 2: Showing Diabetic retinopathy prevalence

Figure 3: The following were the findings of severity of diabetic retinopathy in controlled and uncontrolled diabetics

Figure 4: The 1200 patients enrolled in the study were divided into five groups

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Figure 5: Pie chart(5A) and Bar diagram (5B) showing the percentages of diabetics developing diabetic retinopathy in relation to duration of disease.

Figure 6: Pie diagram showing severity of DR in 0-5 years group

Figure 7: Pie diagram showing severity of DR in 5-10 years group

Figure 8: Pie Diagram showing Severity of DR in 10-15 years group

Figure 9: Pie diagram showing severity of DR in 15-20 years group

Figure10: Pie diagram showing severity of DR in 20plus years

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