

### Clinical Study of Risk Factors for Diabetic Maculopathy

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#### Abstract :

**Aim:** To determine the association between various systemic risk factors with diabetic maculopathy.

**Methodology:** A prospective observational study was conducted on 50 patients having diabetic maculopathy. Patients with maculopathies secondary to Vitreous Haemorrhage, Ocular disorders like Glaucoma, Uveitis, Advanced Diabetic Eye Disease, Vitreo-macular traction, maculopathy along with proliferative diabetic retinopathy, ischemic maculopathy, and history of laser treatment in last six months were excluded from the study. Data was collected using a structured proforma that included name, age, sex, occupation, height, weight, history of other systemic diseases like hypertension, investigations and treatment taken in past, family history, duration of DM, smoking, hyperlipidemia, hyperglycemia and nephropathy.

**Results:** Out of 50 patients, 38 (76%) were males and 12 (24%) were females suggestive of male predominance. Mean age of the patient was  $57.36 \pm 11.65$  years in males and  $56.67 \pm 10.17$  years in females. Among 50 patients, 19 patients had diabetes mellitus for 6-10 years duration, 14 patients had diabetes mellitus for 1-5 years, in 12 patients for 11-15 years, in 2 patients for 16-20 years, in 2 patients for 21-25 years and only 1 patient more than 25 years. Mean duration of DM was  $12.2 \pm 6.1$  years. Majority of patients having maculopathy had duration of DM up to 20 years. Among 50 patients, 27 patients (54%) had systemic hypertension, 37 patients (74%) had

uncontrolled blood sugar level, 29 patients (58%) were found to have hyperlipidemia and 20 patients (40%) had nephropathy. Among 50 patients, pseudophakia was noted in 7 patients (14%), obesity was noted in 21 patients (42%). Eleven patients (22%) were found to have anemia, 6 patients (12%) had family history of DM and 13 patients (26%) had history of smoking.

**Conclusion:** Hyperglycemia, hypertension, duration of DM, hyperlipidemia are the major risk factors for the development and progression of diabetic maculopathy. While anemia, smoking, obesity and family history of DM is the less significant risk factors.

**Keywords:** Diabetic Maculopathy, Diabetic Macular edema, Diabetic retinopathy.

#### Introduction:

Diabetes mellitus (DM) includes a group of common metabolic disorders which share a common phenotype of hyperglycemia. A complex interaction of genetics and environmental factors are known to play a causative role. It is responsible for end-stage renal disease, non-traumatic lower extremity amputations and adult blindness. Vascular complications of DM encompass microvascular (retinopathy, nephropathy, and neuropathy) and macrovascular (coronary artery disease, cerebrovascular disease).<sup>1</sup> Microvascular complication in the form of diabetic retinopathy is a leading cause of visual disability and blindness. Legal blindness between the age group of 20-60 years also, can be attributed to diabetic retinopathy.<sup>2</sup> India is regarded as "Diabetic capital of the world" as there are approximately 65.1 million people in India having diabetes which is predicted to increase to 109 million by 2035.<sup>3</sup> The prevalence of diabetic retinopathy in general population is 3.5% and the prevalence of diabetic retinopathy in the population with diabetes mellitus is 18.0% in India.<sup>4</sup> Diabetic macular edema (DME) is the most common cause of decreased visual acuity in patients with type II DM. Prevalence of DME is 6.81 % in diabetic population.<sup>5</sup> DME can be defined as retinal thickening at or within 1 disc diameter of the center of the macula or the presence of definite hard exudates.<sup>6</sup>

A multitude of risk factors like hyperglycemia, duration of DM, hypertension, hyperlipidemia, smoking, anemia, obesity, pregnancy, life style, previous cataract surgery and family history are found to be associated with the development and progression of diabetic maculopathy.<sup>7</sup>

Amongst which, poor glycemic control plays a crucial role. Despite the introduction of new medications in the treatment of diabetic macular edema, laser photocoagulation remains as the gold standard treatment.<sup>8</sup> Localized macular scatter or grid-pattern laser photocoagulation treatment for diffuse macular edema showed a tendency for resorption of macular edema with improvement in visual acuity.<sup>9</sup> Early detection is a pre-requisite which can be achieved by identifying high risk groups among the diabetics, screening them for retinopathy and treating them appropriately to prevent blindness from diabetic retinopathy. Health education to the general population about high risk factors is necessary.

The present study is undertaken to determine the association between various systemic risk factors with diabetic maculopathy.

#### Methodology:

It was a prospective observational study which was conducted at Department of Ophthalmology in a tertiary care teaching hospital in rural Maharashtra and was carried out over a period of two years. Patients having maculopathy due to diabetes were included in the study during study period. Patients with maculopathies secondary to causes other than diabetes mellitus, Vitreous Haemorrhage, Ocular disorders like Glaucoma, Uveitis, Advanced Diabetic Eye Disease, Vitreo-macular traction, Maculopathy along with proliferative diabetic retinopathy, History of laser treatment in last six months were excluded from the study. Total 50 patients of diabetic maculopathy attending the Ophthalmology OPD were included in the study and information was obtained from the selected patients using a structured proforma that included name, age, sex, occupation, height, weight, nature and duration of symptoms, history of systemic diseases like hypertension, diabetes mellitus (DM), treatment taken in past, family history of DM and addictions if any like smoking. Patients were investigated for relevant laboratory investigations. A written informed consent was obtained from each patient for preoperative workup procedures and special investigations like Fundus Fluorescein Angiography

(FFA). Objectives of the study were to study various types of diabetic maculopathy and to determine the associated systemic risk factors. Approval for carrying out the study was taken from Ethical Committee of the Institute.

#### Results:

In the present study, out of 50 patients, 38 (76%) were males and 12 (24%) were females which is suggestive of male predominance. Mean age of the patient was  $57.36 \pm 11.65$  years in males and  $56.67 \pm 10.17$  years in females. This shows that occurrence of diabetic maculopathy is more in the 50-60 years age group followed by 60-70 years irrespective of sex distribution.

**Table No.1:** Distribution of patients according to age and sex

Age in years & Gender	Male		Female		Total	
	No. of patients	%	No. of patients	%	No. of patients	%
< 40	0	0	2	16.66%	2	4%
40-50	9	23.68 %	1	8.33%	10	20%
50-60	14	36.84%	4	33.33%	18	36%
60-70	13	34.21%	3	25%	16	32%
>70	2	5.26%	2	16.66%	4	8%
Total	38	100%	12	100%	50	100%
Mean $\pm$ SD	$57.36 \pm 11.65$		$56.67 \pm 10.17$		$57.52 \pm 10.81$	

In the study, duration of diabetes mellitus ranged from 1-30 years. Among 50 patients, 19 patients had diabetes mellitus for 6-10 years duration, 14 patients had diabetes mellitus for 1-5 years, in 12 patients for 11-15 years, in 2 patients for 16-20 years, in 2 patients for 21-25 years and only 1 patient more than 25 years. Mean duration was  $12.2 \pm 6.1$  years. Majority of patients having maculopathy had duration of DM up to 20 years.

**Table No.2:** Distribution of patients according to duration of diabetes mellitus

Duration of diabetes mellitus (years)	No. of patients having diabetic maculopathy	Percentage (%)
1--5	14	28%
6--10	19	38%
11--15	12	24%
16--20	2	4%
21--25	2	4%
25--30	1	2%
Total	50	100%
Mean $\pm$ SD	$9.82 \pm 7.61$	

Among 50 patients, 27 patients (54%) had systemic hypertension and 23 patients (46%) were not associated with systemic hypertension. By applying Z test of difference between two proportions, the proportion of hypertension is significantly higher in diabetic maculopathy patients. ( $p=0.0574$ )

In this study, it was found that 37 patients (74%) had uncontrolled blood sugar levels while 13 patients (26%) had blood sugar levels under control. The proportion of hyperglycemia is significantly higher in diabetic maculopathy patients. ( $p=0.0124$ )

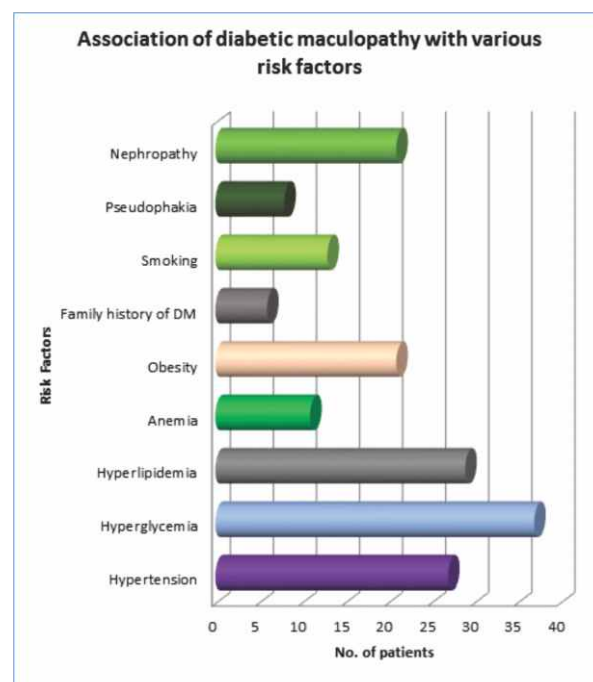
Among 50 patients, 29 patients (58%) were found to have hyperlipidemia while in 21 patients (42%) hyperlipidemia was not present. By applying Z test of difference between two proportions, the proportion of hyperlipidemia is significantly higher in diabetic maculopathy patients. ( $p=0.0256$ )

It was observed that, 11 patients (22%) were found to have anemia while in 39 patients (78%) anemia was absent. The proportion of anemia is not significant in diabetic maculopathy patients. ( $p=0.148$ )

Among 50 patients, obesity was noted in 21 patients (42%) while in 29 patients (58%) it was absent. By applying Z test of difference between two proportions, the proportion of obesity is not significant in diabetic maculopathy patients. ( $p=0.256$ )

Total 6 patients (12%) had family history of DM while in 44 patients (88%) it was not present. Thus, the proportion of family history of DM is not significant in diabetic maculopathy patients. ( $p=0.17$ )

Among 50 patients, 13 patients (26%) had habit of smoking while in 37 patients (74%) it was not present. This shows that the proportion of smoking is not significant in diabetic maculopathy patients. ( $p=0.208$ )



**Graph 1:** Association of diabetic maculopathy with various risk factors

#### Discussion:

India is becoming one of the diabetic capitals in the world. Due to the increasing diabetic population, the complications due to diabetes are also growing. Diabetes is responsible for microvascular angiopathy leading to end organ damage. One of the organs involved is the eye where it leads to diabetic retinopathy. Diabetic maculopathy is responsible for decreased visual acuity in patients with type II DM. Extensive capillary leakage and localized edema by focal leakage from microaneurysms leads to diffuse macular edema. The onset and progression of diabetic maculopathy is dependent on a number of predisposing risk factors of which important risk factors are uncontrolled blood sugar levels, duration of onset of diabetes mellitus, hyperlipidemia and hypertension. Thereby, good control and the treatment of risk factors is necessary.

In the study by Lawson et al, the mean patient age was 58 years (range 29-73 years).<sup>10</sup> Sander et al, in their study observed that the mean age of patients was 57 years (range 28-71 years).<sup>11</sup> Mean age group of patients in the present study matches with the studies by Lawson et al, Sander et al.<sup>10,11</sup>

In the present study of 50 patients, 38(76 %) were males and 12 (24%) were females, showing male predominance. Male predominance in the present study could be due to more number of males presented themselves to the hospital than females. Study place being rural area, lack of awareness of importance of eye checkup among female population along with an element of illiteracy and other social factors could be the contributing factor for lesser number of female reporting to the hospital.

Zhang et al in their study concluded that diabetic maculopathy often occurred within 10 years of diabetic duration and its severity and incidence increased year by year.<sup>12</sup> Shetty K J et al, in their study quoted that the duration of diabetes in patients with diabetic maculopathy ranged from 8-18 years in type 2 diabetes (mean 12.7 years) and 16-21 years in type 1 diabetes (mean 18.7 years).<sup>13</sup> Diabetic maculopathy occurred more often within 10 years of diabetic duration in the study done by Zhang et al which matches with the present study. Therefore, it can be said that, with the increasing duration of DM, occurrence of diabetic maculopathy is more.

The UKPDS showed that hypertension is an independent risk factor for diabetic retinopathy.<sup>14</sup> Sjolie AK et al, in their study observed raised blood pressure is one of the important modifiable risk factor of diabetic retinopathy.<sup>15</sup> Muawyah D. Al-Bdour et al, in their study observed hypertension was detected in 59.8% of the patients. In this study, high blood pressure was found to be significantly associated with NPDR and maculopathy.<sup>16</sup> In the study by Espiritu RE, there was no significant association of hypertension with maculopathy.<sup>17</sup> In the UKPDS and studies done by Sjolie AK et al, Muawyah D. Al-Bdour et al<sup>15,16</sup> hypertension was found to be significantly associated with diabetic maculopathy, which is similar to the present study. All the patients having ischemic maculopathy were found to have hypertension as one of the risk factors. Therefore, hypertension is one of the important risk factors associated in development of ischemic maculopathy.

Ong Ming Jew et al in his study showed that,

hyperglycemia is a strong risk factor diabetic retinopathy and diabetic macular edema.<sup>18</sup> Diabetic Control and Complication Trial (DCCT) study showed that the total lifetime exposure to hyperglycemia was the principle determinant of the risk of retinopathy and there was a continuous (though non-linear) relationship between this risk and mean HbA1C.<sup>19</sup> Uncontrolled hyperglycemia in our study again can be explained as to unawareness and negligence from patients towards compliance to treatment advised. HbA1C would have been a better indicator to comment upon the hyperglycemic control. In the present study, all the patients having diffuse DME were found to be suffering from nephropathy.

In the present study, certain risk factors like uncontrolled hyperglycemia, duration of DM, hypertension, hyperlipidemia and pseudophakia were found to be highly significant with diabetic maculopathy. While risk factors like anemia, obesity, family history of DM, nephropathy and smoking were not found to be highly significant with diabetic maculopathy. This could be due to the relatively small sample size under the study.

#### Conclusion:

Hyperglycemia, hypertension, duration of DM, hyperlipidemia and pseudophakia are the strong risk factors for the development and progression of diabetic maculopathy. While anemia, smoking, obesity and family history of DM and nephropathy are the least significant risk factors.

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