



An Observational Study To Evaluate Severity Of Diabetic Retinopathy And Incidence Of Diabetic Nephropathy In Patients With Type II Diabetes Mellitus

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Abstract

Background: Diabetes mellitus is a metabolic disorder which causes disturbance in the carbohydrate, protein and fat metabolism because of partial or complete deficiency of insulin secretion or action. The hallmark of generalized macroangiopathy occurring in a patient with diabetes is Diabetic retinopathy. Apart from its vision threatening effects, the presence of diabetic retinopathy increases the risk of life threatening systemic vascular complications. Early diagnosis and intervention remains the key for preventing development and progression of diabetic retinopathy and nephropathy.

Objective: To analyse the severity of diabetic retinopathy among Type 2 DM patients and to ascertain the correlation and to quantitatively assess diabetic nephropathy with the severity of diabetic retinopathy.

Methods: An Observational study will be conducted on 100 patients who are diagnosed to have Type 2 DM during the period of one year (November 2019 to November 2020) fulfilling the inclusion & exclusion criteria in Rajarajeswari Medical College and Hospital, Bangalore. Assessment of diabetic retinopathy, diabetic nephropathy was done for all patients. Analysis of nephropathy depending on severity of retinopathy was done.

Results: It was found from the study that there was significant statistical association between diabetic retinopathy and diabetic nephropathy (P value-0.00) and albuminuria was found in all the stages of diabetic retinopathy. It was also inferred from the study that more the duration of diabetes, higher are the chances of diabetic macroangiopathy in all the grades of diabetic retinopathy.

Conclusion: The study thus concludes that diabetic retinopathy increases the risk of diabetic nephropathy.

Keywords: Diabetes mellitus; Diabetic retinopathy; Diabetic nephropathy; Albuminuria

Introduction

Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels which results from the body's inability to either produce insulin or resistance to insulin action, or both [1]. In 2014, 8.5% of adults aged 18 years and older had diabetes. In 2019, it was found that diabetes mellitus was the major cause of 1.5 million deaths and 48% of all deaths due to diabetes occurred before the age of 70 years [2].

Most common microvascular complication of diabetes is Diabetic retinopathy (DR) [3]. Diabetic retinopathy is described by progressive alterations in the microvasculature which lead to retinal ischemia, neovascularization, altered retinal permeability and macular edema [4]. DR is one of the leading causes of vision loss in adults aged 20–74 years [5]. Diabetic nephropathy (DN) is one of the leading chronic microvascular complications in diabetes mellitus (DM) and major cause of end-stage renal disease (ESRD), which accounts for nearly half of all

incident cases of ESRD in the developed world [6,7]. There is a growing concern for Asia being the region for diabetic epidemic. Despite this the epidemiological data for diabetic retinopathy is scarce [8]. This study is mainly undertaken to analyse the severity of the retinopathy among Type 2 DM patients and to ascertain the correlation and to quantitatively assess Diabetic nephropathy with the severity of Diabetic retinopathy.

Diabetes mellitus and Diabetes Retinopathy can be detected early by sending for investigations like FBS, PPBS, HbA1C, Blood urea and creatinine, urinary albumin which helps in detecting nephropathy and correlate it with the severity of Diabetic retinopathy.

Methodology:

The study was carried out in the department of Ophthalmology, Rajarajeswari Medical College Hospital, Bangalore over a period of 12 months.

Sample size estimation done by using Yamane formula $n = \frac{N}{1 + Ne^2}$, (where n=sample size, N=study population-taken as 125, e=coefficient of error) = $\frac{125}{1 + 125 \times 0.05^2} = 95.2 \approx 100$. So 100 Type 2 DM patients visiting the OPD and ward at Rajarajeswari medical college Hospital, Bangalore, were evaluated for the study. (Source of formula: Yamane, Taro. (1967), statistics: An Introductory Analysis, 2nd edition, New York: Harper and Row)

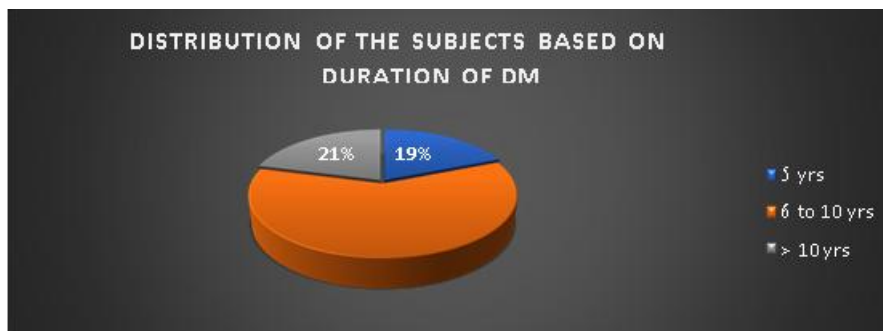
Inclusion Criteria: Patients giving consent for the study, patients diagnosed with Type 2 Diabetes on treatment, duration: > 5 years of diabetes mellitus, age- 40 years and above

Exclusion Criteria: Patients not giving consent for the study, pregnant women, patients in whom fundus cannot be visualized, Glaucoma patients, Dialysis Patients.

Method of collection of data: Patient’s examination was performed as per the proforma, meeting the criteria for the study after an informed consent. A detailed history of each patient regarding age, duration of diabetes, the anti-diabetic treatment they are on and any associated illness were taken, followed by complete general examination, systemic examination and ocular examination including visual acuity, slit lamp examination and fundus examination. Based on ETDRS criteria, patients were graded according to their severity of retinopathy. Blood samples were used to analyse the blood sugar levels, urea and creatinine. Nephropathy graded based on their urinary albumin levels.

Results: A total of 100 patients were enrolled in this study. The mean age of study participants was 57.72 ±8.61 ranging 40-70 years of age. Out of which 44% are females and 56% are males. Mean duration of diabetes was found to be 7.81 years.

Figure-1: Distribution of the subjects based on duration of diabetes mellitus



On fundus examination majority of the patients were found to have Diabetic Retinopathy changes. Out of which, 38% of the patients showed mild NPDR, 37% showed moderate NPDR, 11% showed severe NPDR, 5% showed early PDR, 2% showed HR PDR, 1% showed DM without any changes (Table 1).

Table-1: Distribution of the subjects based on fundus of right and left eye

Fundus	RE		LE	
	Frequency	Percentage	Frequency	Percentage

DM without retinopathy	1	1.0	1	1.0
Early PDR	5	5.0	5	5.0
HR PDR	2	2.0	2	2.0
Mild NPDR	38	38.0	38	38.0
Moderate NPDR	37	37.0	37	37.0
Severe NPDR	11	11.0	11	11.0
Very Severe NPDR	6	6.0	6	6.0
Total	100	100.0	100	100.0

Based on blood urea, creatinine and albumin analysis, it was found that 63% of patients showed abnormal and 37% showed normal blood urea levels. 65 patients showed abnormal and 35 patients had normal serum creatinine level. 25 showed macroalbuminuria,39 showed microalbuminuria,36 showed normoalbuminuria.

The study showed that with the increasing age of study participants, severity of diabetic retinopathy increases, which was statistically significant ($p < 0.01$). Significant correlation between fundus changes and diabetic nephropathy was found (p value- 0.00) (Table 2). Among study participants, those who had higher blood urea levels showed severe grades of diabetic retinopathy (Table 3) but there was no association between serum creatinine levels and grades of diabetic retinopathy (Table 4).

Table 2: cross-tabulation of fundus with albuminuria

Fundus		Nephropathy			Total
		Macro A	Micro A	NA	
DM	Count	1	0	0	1
	%	1.0%	0.0%	0.0%	1.0%
Early PDR	Count	5	0	0	5
	%	5.0%	0.0%	0.0%	5.0%
HR PDR	Count	2	0	0	2
	%	2.0%	0.0%	0.0%	2.0%
Mild NPDR	Count	0	3	35	38
	%	0.0%	3.0%	35.0%	38.0%
Moderate NPDR	Count	1	35	1	37
	%	1.0%	35.0%	1.0%	37.0%
Severe NPDR	Count	10	1	0	11
	%	10.0%	1.0%	0.0%	11.0%

Very Severe NPDR	Count	6	0	0	6
	%	6.0%	0.0%	0.0%	6.0%
Total	Count	25	39	36	100

	%	25.0%	39.0%	36.0%	100.0%
Chi-square value-167.82					
p value-0.00*					

Table 3: mean scores of blood urea based on fundus changes among the study participants

Fundus	N	Minimum	Maximum	Mean	S.D
DM without Retinopathy	1	48	48	48.00	
Early PDR	5	54	73	64.60	7.893
HR PDR	2	64	67	65.50	2.121
Mild NPDR	38	19	54	29.97	8.165
Moderate NPDR	37	38	65	49.19	4.440
Severe NPDR	11	52	68	60.64	5.464
Very Severe NPDR	6	61	69	65.17	3.312

Table 4: mean scores of serum creatinine based on fundus

Fundus	N	Minimum	Maximum	Mean	S.D
DM without retinopathy	1	3.20	3.20	3.2000	
Early PDR	5	2.00	5.20	4.0600	1.314
HR PDR	2	2.20	5.20	3.7000	2.121
Mild NPDR	38	0.50	2.70	.9316	.47653
Moderate NPDR	37	1.20	3.90	2.4811	.60866
Severe NPDR	11	3.00	6.20	4.3727	.98295
Very Severe NPDR	6	4.10	5.40	4.6333	.42269

Discussion:

Diabetes mellitus is one of the considerable health issues which has a notable impact on the socioeconomic living of an individual. It results in an

everlasting damage, malfunction and organ failure like blood vessels, heart, eyes, nerves and kidney. NK Chowta et al [9] showed in their

study that, out of 100 patients 59 were males and 41 were females, which was similar to our study. Mean age at onset of diabetes mellitus in microalbuminuric patients was 51.7 ± 9.8 years where as in our study the mean age of the participants was 57.7 ± 8.6 . Maximum number of patients had duration of diabetes between six months and five years where as in our study it was 6-10 years. Walid Abdelghaffar et al [10] in their study it was found that subjects with micro- and macroalbuminuria are more likely to have DR compared with those without albuminuria, which was comparable with our study. Chen H et al [11] reported that microalbuminuria can predict the increased risk for diabetic retinopathy development which was correlated with our study.

Conclusion:

Though Diabetes mellitus has high prevalence, It is not much seen in the rural population. Because of the ignorance, limited economy and non-availability of medical facilities, most of the patients visit hospital at a much later stage and they are not able to explain the history and progress of the disease. If there are any desperate changes in the lifestyle of the rural population, in India, Prevalence of type II diabetes mellitus might increase in the future.

In such situations, early predictors of retinopathy helps in delaying the disease progression and in the management. Albumin in urine shows the state of generalized vascular damages. Fundus examination helps in predicting impending Diabetic nephropathy. Association between albuminuria and retinopathy is statistically significant. Albuminuria is found to be an indicator of microvascular damages, for diabetic retinopathy and diabetic nephropathy. In our study, it was inferred that normal urinary albumin levels was very rare to find in cases with mild – moderate NPDR. Microalbuminuria was a definite finding in all patients with mild and moderate NPDR. Macroalbuminuria was found to be associated with severe NPDR, very severe NPDR and PDR.

We conclude by saying that, Diabetic retinopathy increases the risk of albuminuria, higher the grade of retinopathy, higher the chances of patients developing macroalbuminuria. The study shows the importance of regular and periodic assessment of all the cases of diabetic retinopathy with all the relevant

investigations like anterior segment examination, posterior segment examination, sugars to monitor the status of diabetes and for early intervention which helps in delaying the disease progression, which in turn helps to prevent blindness.

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