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# Study of Prevalence of Diabetic Retinopathy in Diabetics with Microalbuminuria

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**Abstract:** ***Background: The concordance of microalbuminuria and diabetic retinopathy (DR) has been well reported in persons with type 1 diabetes; however, for type 2 diabetes, there is paucity of data especially from population based studies. The aim of this study was to estimate the prevalence of microalbuminuria among persons with type 2 diabetes. Methods: A population-based cross sectional study was conducted in cohort of 160 subjects with type 2 diabetes. All the subjects underwent comprehensive eye examination with the help of indirect ophthalmoscope by the practicing ophthalmologist. A morning urine sample was tested for albuminuria. Subjects were considered to have microalbuminuria, if the urinary albumin excretion was between 30 and 300 mg/24 hours. The statistical software used was SPSS for Windows and $X^2$ test, to compare proportions amongst groups were used. Results: The prevalence of microalbuminuria in the study subjects was 27.5% (44/160). Overall prevalence of Diabetic Retinopathy was 30 % (48/160),5% of which showed proliferative diabetic retinopathy. The prevalence of Diabetic Retinopathy in microalbuminuria patients was 45.4% (20/44) and in patients with normoalbuminuria is 24.1(28/116). Association of MICROALBUMINURIA and DR was statistically significant (0.00867). Conclusions: The presence of Microalbuminuria in Diabetic patients is highly associated with the development of Diabetic Retinopathy. The study suggests that microalbuminuria may be a marker for the risk of development of proliferative retinopathy.***

**Keywords:** Diabetic Retinopathy, Microalbuminuria, Normoalbuminuria, Type 2 Diabetes

## 1. Introduction

Diabetic retinopathy (DR) is the leading cause of new cases of legal blindness among working-age individuals. The more advanced the DR, the greater the risk of visual loss. The main risk factors for the development or progression of DR are duration of diabetes mellitus (1), poor glycemic control (1) and hypertension (2). As the number of persons with diabetes increases, the development of microvascular complications like retinopathy, nephropathy and neuropathy also rises. The magnitude of damage caused by these microvascular complications of diabetes stresses the need for sensitive markers of screening for retinopathy and nephropathy. The sensitive marker for the detection of diabetic nephropathy is to estimate excretion of microalbumin in urine; and for the detection of diabetic retinopathy (DR), to have a fundus evaluation after pupillary dilatation [3, 4]. The concordance of microalbuminuria and DR has been well reported in persons with type 1 diabetes (5); however, for type 2 diabetes, there is paucity of data especially from population-based studies regarding the association of microalbuminuria with DR [6-9].

According to a report by the World Health Organization (WHO), the prevalence rates of nephropathy after 15 years of diabetes ranged between 17.7 and 56.6% in men and between 11.9 and 71% in women. DR is responsible for 4.8% of the 37 million cases of blindness throughout the world [10].The present population based study was carried out to estimate the prevalence of microalbuminuria in type 2 diabetes mellitus and report its influence as a risk factor for the presence and severity of DR.

## 2. Materials and Methods

This study was conducted on patient with diabetis type 2 who came to department of ophthalmology in our tertiary care hospital between the year 2017-18.

Patients diagnosed with diabetes mellitus in accordance with WHO criteria i.e fasting blood glucose ≥ 126 mg/dl or two-hour blood glucose ≥ 200 mg/dl during an oral glucose tolerance test or symptoms of diabetes plus random blood glucose ≥ 200 mg/dl.

Subsequent to completing preliminary data that include personal questionnaire, patients laboratory tests and opthalmological examination were completed.

All patients were included according to the predefined inclusion and exclusion criteria.

**Inclusion criteria:** All patients with diabetes mellitus of more than 5 years of duration.

**Exclusion criteria:** Macroalbuminuria, Congestive cardiac failure, Haematuria, Marked hypertension, Urinary tract infection, all acute and chronic kidney diseases.

Three urine samples were taken during three to six months and if two samples were positive, microalbu- minuria was affirmed. (The device shows the ratio of albu- min to creatinine in mg/g). If the ratio was less than 30, the patient was normoalbuminuric. Ratios between 30– 300 mg/g were indicative of microalbuminuria and above 300 mg/g revealed macroalbuminuria.

Ophthalmologic examination and the patients were categorized according to the degree of their retinopathy.

No retinopathy

Mild Nonproliferative Diabetic Retinopathy (NPDR)

Moderate NPDR

Severe NPDR

Proliferative diabetic retinopathy (PDR).

**Statistical analyses** were performed using the statistical software (SPSS for Windows, ver.13.0 SPSS Science). The results were expressed as mean ± SD if the variables were continuous, and as percentage, if categorical. Student t-test for comparing continuous variables, and X2 test, to compare proportions amongst groups were used. P value of ≤0.05 was considered as significant.

## 3. Results

A total of 160 patients (73females and 87 males) were included in this study. The age average was 62 ± 9 SD years and the patients' duration of diabetes was between 5 to >15years (Mean = 11± 3 SD years). Duration of diabetes was between 5-10 years in 40% of the patients, between 11-15 years in 35% and more than 15 years in 25% of them. Duration of diabetes was a strong predictor of severity of retinopathy (p = 0.000003) (table1).

Overall prevalence of DIABETIC RETINOPATHY (DR) was 30 % (48/160) ,with Prevalence of DR in NORMOALBUMINURIC patients was 24.1% (28/116) and the Prevalence of DR in MICROALBUMINURIC patients was 45.4% (20/44).

30% of the patients had retinopathy to some degrees, 12.5% had mild NPDR, 10% moderate NPDR, 2.5% severe NPDR and 5 % had PDR.

Out of 160, 20 patients had DR with Microalbuminuria and the p value came out to be 0.00867. Association of MICROALBUMINURIA and DR was statistically significant. (p value <0.05) (Table 2)

Examination of urine samples in 116 subjects (72.5%) showed normal range of albumin excretion (normoalbuminuria). 27.5% (44/160) of the patients, were microalbuminuric.

Table 3 shows significant relationship between different grades of retinopathy and albuminuria (p = 0.001).

## 4. Discussion

The present study primarily reports the prevalence of albuminuria (micro and normo ) amongst persons with type 2 diabetes and evaluates its role as a risk factor for presence and severity of DR. Numerous studies were carried out to determine the prevalence of retinopathy and albuminuria in diabetes Type 2. These studies yielded different rates between 16 to 53.4% for retinopathy [11-16]. This study showed the overall prevalence rate of DR around 30% which is somewhere in median range. The prevalence of DR in Microalbuminuric patient is around 45.4% in this study and it is around 24.1% in Normoalbuminuric patients whereas the prevalence of normoalbuminuria in the study is 72.5%. The variation in rate could be as a result of different methods used in those studies, the population and or the races involved, or variation in controlling blood sugar level. The prevalence of microalbuminuria in the study is 27.5%. Parving et al reported the incidence rate of 22% of microalbuminuria in diabetes type 2 [17] whereas Lunetta reported the incidence rate of 15% [11]. The prevalence of microalbuminuria was reported to be around 27% by Unnikrishnan et al [18]. The above-mentioned studies show that there is a significant relationship between the degree of retinopathy and albuminuria. This study highlighted that subjects with microalbuminuria were around 2 times as likely to have DR than normoalbuminuric patients. A similar trend was noted for sight-threatening DR, the odds were 2.5 times for microalbuminuria and 14 times for macroalbuminuria. The DCCT in type 1 diabetes mellitus reported that there is a relationship between DR and diabetic nephropathy [19]. Boelter et al [20] also reported the presence of renal involvement, including urinary albumin excretion within the microalbuminuria range in type 2 diabetic patients with proliferative diabetic retinopathy. They emphasized that all patients with proliferative diabetic retinopathy should undergo an evaluation of renal function including urinary albumin measurements. A few studies have identified that the renal changes seen in individuals with both microalbuminuria and retinopathy had a distinct pattern compared to those having microalbuminuria without retinopathy. Severe retinopathy has been described as more closely associated with glomerulosclerosis, with Kimmelstiel-Wilson nodules, than with mesangial sclerosis [21]. However there are few studies opposing such relationship. Erasmus et al showed that in 113 patients suffering from NIDDM, the incidence rate of microalbuminuria was as high as 54% among males and 59% among females. Prevalence of retinopathy was 16%. They concluded that microalbuminuria may not predict retinopathy and occurs independently from either glycaemic control or elevated blood pressure levels. The population chosen for the study influences the different incidences achieved in various studies. For example, 5–6% of normal nondiabetic individuals in the united Kingdom and the united States of America have microalbuminuria whereas in South Korea this value is 12.2% and in Finland 30–35% [22].

The association between microalbuminuria and DR observed in the present study could be explained by the view that microalbuminuria might represent a state of generalized vascular dysfunction [23]. Enzymes involved in the metabolism of anionic components of the extracellular matrix (e.g. heparan sulphate proteoglycan) vulnerable to hyperglycaemia, seem to constitute the primary cause of albuminuria and its associated complications As we know that HbA1c, BMI, and length of illness, are contributing factors for retinopathy, this study shows that microalbuminuria is also a contributing factor in the development of retinopathy and this correlation can be explained by the common mechanism involved in tissue damage by all those factors. In addition to blood sugar level, there are also other factors which damage vessels in retina

and kidney. For example, Klein et al showed that microalbuminuria could be seen in 29.2% of insulin taking patients and 22% of non-insulin dependent patients. Therefore, insulin can also have a role in nephropathy [24].

In a study on 497 normal nondiabetic cases who were above 40 years in Seoul, Kim et al, after regression analysis, reported that fasting plasma level of insulin and systolic blood pressure have independent correlation with micoralbuminuria [22]. Besides common mechanisms, renal damage may accelerate retinopathy which is associated with increased blood pressure and serum levels of fibrinogen and lipoproteins.

There are potential shortcomings in our study that require comment. A major limitation was the use of single urine sample for estimation of microalbuminuria for logistic reasons. However; this may not change the inferences drawn as most epidemiological studies have followed methodology of single urine sample measurement. Renal involvement is a strong predictor of mortality [25], also in population-based patient samples. Therefore life-time prevalence of renal involvement is much greater than the prevalence found in this cross-sectional survey. The presence of isolated microalbuminuria is also believed to be a biomarker of widespread vascular injury and atherosclerotic burden. In this sense, it does not measure a "kidney disease" per se, but only a secondary and indirect effect of a distant disease process on kidney physiology [26]. Thus, microalbuminuria is more a marker of endothelial dysfunction instead of a marker of renal impairment [27-29]. It must be remembered that renal involvement only identifies a group of diabetic patients at high risk of developing complications, including DR, and these patients may benefit from intensive treatment.

Also microalbuminuria has positive correlation with incidence of coronary heart disease. Albuminuria also has been considered as a predictor of diabetic retinopathy and coronary heart disease. Thus excretion of albumin in urine can be regarded as a sign of kidney involvement and can reflect generalized vessel damage throughout the body. Further prospective studies should be carried out to evaluate the effect of lowering albumin excretion on the reduction of blood vessel damage

## 5. Conclusions

Microalbuminuria is thus associated cross sectionally with the presence of retinopathy in persons with diabetes type II. These data suggest that microalbuminuria may be a marker for the risk of development of proliferative retinopathy. The presence of Microalbuminuria in Diabetic patients is highly associated with the development of Diabetic Retinopathy. Thus diabetic patients who have microalbuminuria may benefit from close ophthalmologic follow up.

**Table 1:** Relation of Duration of Diabetis and Different Type of Retinopathy

| Duration of Diabetes | Types of Retinopathy | | | | | Total |
|---|---|---|---|---|---|---|
| | No DR | Mild NPDR | Moderate NPDR | Severe NPDR | PDR | |
| 5-10 YEARS | 57 (89.1%) | 4 (6.3%) | 2 (3.1%) | 0 (0%) | 1 (1.6%) | 64 (100%) |
| 11-15 YEARS | 42 (75 %) | 6 (10.8%) | 5 (8.9%) | 1 (1.8%) | 2 (3.5%) | 56 (100%) |
| >15 YEARS | 13 (32.5%) | 10 (25%) | 9 (22.5%) | 3 (7.5%) | 5 (12.5%) | 40 (100%) |
| TOTAL | 112 (70%) | 20 (12.5%) | 16 (10%) | 4 (2.5%) | 8 (5%) | 160 (100%) |

**Table 2:** Association of Microalbuminuria with Diabetic Retinopathy

| Albuminuria | Diabetic Retinopathy | | Total |
|---|---|---|---|
| | Present | Absent | |
| Microalbuminuria | 20 | 24 | 44 |
| Normoalbuminuria | 28 | 88 | 116 |
| Total | 48 | 112 | 160 |

**Table 3:** Relationship between different Type of Retinopathy and Albuminuria

| Albuminuria | Grades Of Retinopathy | | | | | |
|---|---|---|---|---|---|---|
| | No DR | Mild NPDR | Moderate NPDR | Severe NPDR | PDR | TOTAL |
| Normoal- Buminuria | 88 (75.9%) | 11 (9.5%) | 10 (8.6%) | 3 (2.8%) | 4 (3.4%) | 116 (100%) |
| Microal-Buminuria | 24 (54.5%) | 9 (20.4%) | 6 (13.6%) | 1 (2.2%) | 4 (9.1%) | 44 (100%) |
| Total | 112 (70%) | 20 (12.5%) | 16 (10%) | 4 (2.5%) | 8 (5%) | 160 (100%) |

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