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Retinopathy and microalbuminuria in type II diabetic patients

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Abstract

Background: The aim of this study was to identify risk factors for the development of retinopathy and microalbuminuria and their correlation in type II diabetic patients.

Methods: In this cross-sectional study 590 patients suffering from diabetis type II were examined. Fundoscopy was performed by practising ophthalmologist. The ratio of urinary albumin to creatinine was assessed by clinitek 100 (Bayer corporation–USA). HbA1C, height and weight also were measured.

Results: The overall prevalence of retinopathy was 39.3% (232 patients), 5.4% of which showed to be prolifrative diabetic retinopathy (PDR). The diabetic retinopathy had significant inverse correlation with body mass index (BMI) (P = 0.02). HbA1C was higher in patients with PDR (mean = 10.5%) than in patients with no signs of retinopathy (mean = 9.5%) and this difference was statistically significant (P = 0.001). The prevalence of microalbuminuria was 25.9% while 14.5% of the patients revealed to have macroalbuminuria. As expected, diabetic retinopathy and renal involvement were highly positively correlated. (P = 0.001).

Conclusion: Microalbuminuria is associated with diabetic retinopathy in type II diabetic patients and is a reliable marker of retinopathy.

Background

Diabetes mellitus is one of the most common metabolic diseases in which either the hormone insulin is lacking or the body's cells are insensitive to insulin effects. The multi-system effects of diabetes such as retinopathy, nephropathy, neuropathy and cardiovascular diseases are considered important impinging on the public health.

Diabetic retinopathy is one of the leading causes of blindness in the world that increases the chance of loosing the sight about 25 times higher compared to normal individuals [1]. Using new surgical and medical techniques, the incidence of blindness can be reduced up to 90% [2]. Decrease in visual acuity in diabetic retinopathy is either associated with maculopathy or proliferative complications of it. Many studies have been undergone to find out the precipitated factors of retinopathy such as duration and type of diabetes, hyperglycemia, pregnancy, change in hormonal level, genetics and microalbuminuria.

The occurrence of microalbuminuria in diabetes type I is highly predictive of renal and cardiovascular diseases whereas in type II less association of these is observed [3].

The purpose of this study is to evaluate the incidence of microalbuminuria, macroalbuminuria and their relation to diabetic retinopathy and other risk factors such as hyperglycemia, hypertension in diabetes type II.

Methods

This cross sectional study was carried out on the patients with diabetes type II who had referred to Yazd Center of Diabetes Research between the years 2000 to 2001.

The diagnosis of diabetes mellitus was performed according to the World Health Organization (WHO) criteria which had been reported by WHO study group (1985).

Subsequent to completing preliminary questionnaires that included personal data, the patients' ophthalmologic examination and laboratory tests were also completed.

Clinitek 100 (made by Bayer Corporation-Elkhart, IN 46515, USA) was used to measure microalbuminuria. Three urine samples were taken during three to six months and if two samples were positive, microalbuminuria was affirmed. (The device shows the ratio of albumin 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.

Detailed assessment was completed to exclude other possible causes of microalbuminuria. Ophthalmologic examination including visual acuity (by means of snellen charts), intraocular pressure (using Applanation Tonometry), fundoscopy (utilizing slit lamp and contact lenses) and indirect ophthalmoscopy were also completed. If required, fluorescein angiography was ordered. All the relevant examinations were completed by an ophthalmologist 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)

Five minutes after resting in the sitting position, the patients' blood pressure was measured by mercury Sphygmomanometer. BP ≥ 135/80 mmHg was considered abnormal. Patient's medications including hypertensive drugs were also recorded. Body Mass Index (BMI) was also documented. HbA1c was ordered and finally the data were analyzed by chi-square and Fischer exact tests. P values of <0.05 were considered significant.

Results

A total of 590 patients (346 females and 244 males) were included in this study. The existing methods of treatment at the first visit focused on dietary habits alone for 56 patients, oral agents for 453 patients, insulin for 61 patients and insulin plus oral agents for 7 patients. The age average was 54.9 ± 10.2 and the patients' duration of diabetes was between 1 to 32 years (Mean = 10.2 ± 6.6). Duration of diabetes was less than 5 years in 30% of the patients, between 6–10 years in 30% and more than 10 years in 40% of them. Duration of diabetes was a strong predictor of severity of retinopathy (p = 0.001) (Table 1). 39.3 % of the patients had retinopathy to some degrees, 19.2% had mild NPDR, 12% moderate NPDR, 2.7% severe NPDR and 5.4% had PDR. Fifty-two patients (13.3%) had Clinically Significant Macular Edema (CSME). About 200 of patients had BP ≥ 135/80 mmHg, 173 of whom were under treatment with antihypertensive drugs. There was no significant relationship (p = 0.37) between high blood pressure and different degrees of retinopathy. Gender also had no significant correlation with severity of retinopathy (p = 0.31).

The relationship between different types of retinopathy and risk factors such as HbA1C, FBS, BMI and age revealed to be significant (Table 2).

Examination of urine samples in 330 subjects (59.5%) showed normal range of albumin excretion (normoalbuminuria). 25.9% of the patients, were microalbuminuric and 14.5% had macroalbuminuria. Table 3 shows significant relationship between different grades of retinopathy and albuminuria (p = 0.001).

Discussion

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 [4-9]. Our study showed the prevalence rate of 39.3% which is somewhere in median range. 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 and macroalbuminuria in our study was 25.9% and 14.5% respectively. Parving et al reported the incidence rate of 22% of microalbuminuria in diabetes type 2 [10]whereas Lunetta reported the incidence rate of 15% [4]. The above-mentioned studies show that there is a significant relationship between the degree of retinopathy and albuminuria. 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 and hypertention was 16% and 41%

Table 1: Relationship between duration of diabetes and different types of retinopathy

Duration of retinopathy	Grade of retinopathy					
	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Total
1–5	157 (90.2%)	10 (5.7%)	6 (3.4%)	0 (.0%)	1 (.6%)	174 100%
6–10	122 (69.3%)	36 (20.5%)	13 (7.4%)	1 (.6%)	4 (2.3%)	176 100%
11–15	52 (49.1%)	29 (27.4%)	17 (16.0%)	5 (4.7%)	3 (2.8%)	106 100%
16–32	22 (17.1%)	38 (29.5%)	35 (27.1%)	10 (7.8%)	24 (18.6%)	129 100%
Total	353 (60.3%	113 (19.3%)	71 (12.1%)	16 (2.7%)	32 (5.5%)	585 100%

Table 2: The relationship between retinopathy and its risk factors

Risk factors	p value
HbA1c (%)	0.001
Fasting Blood sugar (mg/dl)	0.001
Body Mess Index (kg/m^2)	0.028
Age (years)	0.014

Table 3: Relationship between different types of retinopathy and albuminuria

Albuminuria	Grade of retinopathy					
	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Total
Normoalbuminuria	239 (72.4%)	57 (17.3%)	26 (7.9%)	1 (0.3%)	7 (2.1%)	330 100%
Microalbuminuria	81 (56.6%)	27 (18.9%)	24 (16.8%)	4 (2.8%)	7 (4.9%)	143 100%
Macroalbuminuria	17 (21.3%)	21 (26.3%)	19 (23.8%)	9 (11.3%)	14 (17.5%)	80 100%
Total	337 (60.9%)	105 (19.0%)	69 (12.5%)	4 (2.5%)	28 (5.1%)	553 100%

respectively. They concluded that microalbuminuria may not predict retinopathy and occurs independently from either glycaemic control or elevated blood pressure levels [8]. 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% [11].

Our study showed that in addition to HbA1c, BMI, and length of illness, microalbuminuria is a contributing factor in the degree of retinopathy ($p = 0.001$) and this correlation can be explained by the common mechanism involved in tissue damage by all those factors. In addition to blood sugar level and blood pressure, 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 [12].

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 [11]. Besides common mechanisms, renal damage may accelerate retinopathy which is associated with increased blood pressure and serum levels of fibrinogen and lipoproteins.

Also microalbuminuria has positive correlation with incidence of coronary heart disease [4,13]. 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.

Conclusion

Microalbuminuria is associated cross sectionaly with the presence of retinopathy in porsons with diabetes type II. These data suggest that microalbuminuria may be a marker for the risk of proliferative retinopathy development. If longitudinal studies confirm these findings, diabetic patients who have microalbuminuria may benefit from close ophthalmologic follow up.

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