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ORIGINAL ARTICLE

The Frequency of Hypertension and Micro-Albuminuria in Diabetic Patients with Retinopathy

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ABSTRACT

The developed world is facing a lot of health problems; among them, one of the major ones is Diabetes Mellitus. In Pakistan, this problem has been increasing consistently due to a plethora of reasons. The current figures of people suffering from Diabetes in Pakistan stand at 7 million and this number has shown colossal growth by the day.

Study Design: A cross-sectional study was performed on 131 patients from January 2017 to August 2017 on all diabetic patients diagnosed already for 5 years or more in the medicine wards of Ayub Teaching Hospital, Abbottabad. Their fasting blood sugar, random blood sugar, and 24-hour urine for protein analysis were measured in addition to recording their blood pressure for the purpose of identification of hypertensive patients. All patients were screened for diabetic retinopathy using a Welch Allyn Fundoscope.

Results: Out of these 131 patients, Hypertension and microalbuminuria were present in 51.9% and 47.3% patients respectively. Diabetic retinopathy was found in 39.7% of study participants. It was evident that microalbuminuria and hypertension are directly related to diabetic retinopathy ($p < 0.05$), It greatly influences it on major levels. Microalbuminuria was associated with the age of the study participants ($p = 0.05$).

Conclusion: This study showed that hypertension and microalbuminuria were significantly associated with the development of diabetic retinopathy.

Keywords: Diabetes Mellitus, Diabetic Retinopathy, Microalbuminuria, Hypertension, GFR.

INTRODUCTION

The developed world is facing a lot of health problems; among them, one of the major ones is Diabetes Mellitus. In Pakistan, this problem has been increasing consistently due to a plethora of reasons. The current figures of people suffering from Diabetes in Pakistan stand at 7 million and this number has shown mammoth growth ever since this was last recorded. The World Health Organization evaluated all the data of Pakistan that was available on Diabetes Mellitus and hence estimated that Pakistan, by the year 2025 will have advanced from its current 8th position on the global rankings to 4th position due to its unprecedented growth in the Diabetes Mellitus cases.[1] Diabetes Mellitus is broadly classified into two categories: Type 1 Diabetes Mellitus, which is caused by a number of factors but primarily it is due to the deficiency of insulin, and type 2 Diabetes Mellitus, which also has numerous causes but primarily is characterized by the presence of insulin resistance with an inadequate compensatory increase in insulin secretion.[2] Furthermore, a number of different complications can cause Diabetes Mellitus; some of them being disorders of the pancreas, endocrinopathies, and drugs of different categories.[3]

Diabetes Mellitus causes a lot of problems in the body among them there are numerous ocular complications as well, Diabetic Retinopathy is regarded as the most severe ocular complication of Diabetes Mellitus; it is regarded to be the most chronic reason for blindness in adults from age 20-74 years.[4] Twenty years into the inception of Diabetes Mellitus, several complications are slowly progressing in the body among them all the people suffering from type 1 Diabetes Mellitus and nearly half of people who suffer from type 2 diabetes mellitus have established one of many forms of Diabetic retinopathy. Often when a person suffering from type 2 diabetes mellitus is diagnosed, they are highly likely to have some type of progressive diabetic retinopathy.[1]

There are a lot of causes associated with the establishment of Diabetic retinopathy among them hypertension, hyperlipidemia, the time span of diabetes, pregnancy, chronic hyperglycemia, and the appearance of deteriorating functions such as nephropathy are regarded as the general indicators.[4] Among these different risk factors, the most prominent one in predicting the development of diabetic retinopathy is microalbuminuria.[5] Correspondingly, hypertension is regarded as an independent risk factor when it comes to the establishment of Diabetic Retinopathy.[6,7] Lowering of blood pressure leads to the reduction in diabetic retinopathy incidence and its progression, this relationship was established by the United Kingdom Prospective Disease Study (UKPDS) and it was successfully demonstrated by different studies.[4] Different risk factors have been closely associated with diabetic retinopathy but a recent study revealed that the male gender, hypertension, time span of diabetes, and substandard glycemic control are some of the major causative reasons for diabetic retinopathy; the age of the patients was regarded confounding factor in this study. [8]

The aim of this study will be to evaluate hypertension and micro-albuminuria as independent factors for increasing the chances of retinopathy in patients with Diabetes Mellitus. This study will provide us with local statistics on the current trends in diabetic retinopathy associated with micro-albuminuria and hypertension and the results of this study will be disseminated to various health professionals so that local guidelines may be generated regarding early diagnosis of microalbuminuria and hypertension in patients with Diabetes Mellitus in particular and also in non-diabetics in general. This will add to the existing framework for the management of patients with Diabetes Mellitus.

MATERIAL AND METHOD

This was a cross-sectional study and it was performed on all diabetic patients admitted in the medical wards of Ayub Teaching Hospital Abbottabad. Only those patients who were already diagnosed as diabetic for 5 years or more were included in the study. Similarly, any patients having retinopathy or renal disease due to any other possible cause were excluded to control confounding. The study was conducted between January 2017 and August 2017. After getting approval from the ethical committee, all patients were advised fasting blood sugar, random blood sugar, and 24-hour urine for protein analysis. After resting the patient in a supine position for 5 minutes blood pressure measurements were also recorded in all these patients using a mercury sphygmomanometer. All patients were screened for diabetic retinopathy using a Welch Allyn Fundoscope. For the remaining fundus examinations, the same fundoscope was used. The patients were examined with fully dilated pupils. The findings from the fundoscope were verified with a slit-lamp biomicroscope with a 90D lens which is the most commonly used lens. Certain

clinical findings were kept in mind before the screening process for diabetic retinopathy was conducted on a fundoscope. Based on these findings the diagnosis for Diabetic Retinopathy would be established; Patients showing a minimum of one microaneurysm in any part of the screening process, displaying characteristic properties of hemorrhages (dot and blot or flamed shaped) or macular degeneration.

The patients with diabetic retinopathy were placed in one group (retinopathy group) and patients without retinopathy were placed in the second group (No Retinopathy). The investigator took all the relevant details of the patients that were examined keeping in mind the appearance of crucial factors that increased the chances of diabetic retinopathy; factors such as hypertension and microalbuminuria. All the details were noted down in a pro forma.

All the data that was gathered on the pro forma was examined in SPSS version 10.0 (Mean ± SD) The standard deviation for different quantitative variables was calculated; among them were systolic and diastolic blood pressure, the time span of diabetes mellitus, and age of the patient. Percentages and frequencies were computed for categorical variables like gender, presence of hypertension, and micro-albuminuria. Data were stratified by age, gender, and duration of diabetes mellitus with respect to outcome variables i.e., presence of hypertension and microalbuminuria. For the analysis, Chi square test was used at 5% significance level to determine association between diabetic retinopathy; hypertension and micro-albuminuria.

RESULTS

The study population comprised 131 diabetic patients of either sex who had been diagnosed with diabetes mellitus for at least 5 years. The youngest and the oldest patient had an age difference of 28 years; the youngest being 31 years of age whilst the oldest was 59 years old. The Mean ± SD age of the study participants was 44.76 ± 8.4 years. Male comprised the majority (56.5%) of the study population. There were 57 (43.5%) females in the study population. Hypertension and microalbuminuria were present in 68 (51.9%) and 62 (47.3%) patients respectively.

Table 1: Gender Distribution of the patients (n = 131)

Gender	Number	Percentage
Male	74	56.5 %
Female	57	43.5 %
Total	131	100%

Table 2: Descriptive Statistics of Age, Duration of Diabetes, Systolic and Diastolic Blood Pressures of Study Population.

	Minimum	Maximum	Standard Deviation
Age	31	59	8.37
Duration of diabetes	7	18	3.53
Systolic blood pressure	120	170	15.18
Diastolic blood pressure	75	95	5.917

Table 3: Frequency of Hypertension in Study Participants

Hypertension	Frequency	Percentage
Present	68	51.9
Absent	63	48.1
Total	131	100.0

Table 4: Frequency of Microalbuminuria among Study Participants

Microalbuminuria	Frequency	Percentage
Present	62	47.3
Absent	69	52.7
Total	131	100.0

Table 5: Frequency of Diabetic Retinopathy in Study Population

Diabetic Retinopathy	Frequency	Percentage
Present	52	39.7
Absent	79	60.3
Total	131	100

Diabetic retinopathy was diagnosed in 52 (39.7%) patients and when cross-tabulated against age, sex, presence of hypertension, and microalbuminuria, it was found to be strikingly related to hypertension (P = 0.012) and microalbuminuria (P = 0.045). When hypertension and microalbuminuria were stratified against age, gender, and duration of diabetes, only microalbuminuria was found to be associated with the age of the patients, however, the association was weaker (P = 0.05).

Table 6: Cross Tabulation of Diabetic Retinopathy and Age of Study Participants

Diabetic Retinopathy	Age of patients		Total	p-value
	31-45 years	46-60 years		
Present	23	29	52	0.99
Absent	35	44	79	
Total	58	73	131	

Table 7: Cross-Tabulation of Diabetic Retinopathy and Sex of Study Participants

Diabetic Retinopathy	Sex		Total	p-value
	Male	Female		
Present	27	25	52	0.39
Absent	47	32	79	
Total	74	57	131	

Table 8: Cross-Tabulation of Diabetic Retinopathy and Microalbuminuria in Study Population

Diabetic Retinopathy	Microalbuminuria		Total	p-value
	Present	Absent		
Present	19	33	52	0.045
Absent	43	36	79	
Total	62	69	131	

Table 9: Cross-Tabulation of Diabetic Retinopathy and Hypertension in Study Population

		Hypertension		Total	p-value
		Present	Absent		
Diabetic Retinopathy	Present	20	32	52	0.012
	Absent	48	31	79	
Total		68	63	131	

Table 10: Cross Tabulation of Hypertension and Age, Gender & Duration of Diabetes Mellitus

Hypertension	Age of patients		Total	p value
	31-45 years	46-60 years		
Present	35	33	68	0.08
Absent	23	40	63	
Total	58	73	13	
Hypertension	Sex			
	Male	Female	Total	p value
Present	37	31	68	0.62
Absent	37	26	63	
Total	74	57	131	
Hypertension	Duration of Diabetes			
	Upto 14 years	> 14 years	Total	p value
Present	40	28	68	0.99
Absent	37	26	63	
Total	77	54	131	

Table 11: Cross Tabulation of Microalbuminuria and Age, Gender & Duration of Diabetes Mellitus

Mircoalbuminuria	Age of patients		Total	p value
	31-45 years	46-60 years		
Present	22	40	62	0.05
Absent	36	33	69	
Total	58	73	131	
Microalbuminuria	Sex			
	Male	Female	Total	p value
Present	33	29	62	0.47
Absent	41	28	69	
Total	74	57	131	
Microalbuminuria	Duration of Diabetes			
	Upto 14 years	> 14 years	Total	p value
Present	40	22	62	0.21
Absent	37	32	69	
Total	77	54	131	

DISCUSSION

Different studies have been conducted in numerous countries on the prevalence and incidence of diabetic retinopathy; there are different factors that directly influence this disease. The studies which concern the factors that influence diabetic retinopathy in Pakistan are rarely conducted and there is meager data available on these risk factors. Different studies were conducted by Stratton; the studies were based on the progress of different risk factors in patients diagnosed with Type 2 Diabetes Mellitus on diabetic retinopathy. Stratton arrived at the conclusion that the male gender, older age, hyperglycemia (with persistently raised levels of HbA1c), smoking, and hypertension were directly influencing the development of retinopathy. They were enhancing its progression.[9] Studies conducted by Chatziralli found something similar in his observations; he evaluated that there are different factors that enhance the progression of diabetic retinopathy; among them are mostly males, diagnosed with diabetes, a history of hypertension, and substandard glycemic control. Age was regarded as a confounding factor in this study.[8] A different study in Asia was conducted on numerous diabetic patients having retinopathy (n = 7577), they all showed similar risk factors in association with this disease. They were; elevated levels of blood glucose and high blood pressure.[10] The main aim of this study was to establish a relation between common risk factors that lead to the progression of diabetic retinopathy. The study was comprehensive and explicit about not comparing Type 1 and Type 2 diabetic patients in their association with being influencing factors of diabetic retinopathy. The study elucidated that hypertension and the presence of microalbuminuria are closely related to the progression of diabetic retinopathy.

In France, Romero conducted a presumptive study on 104 patients that developed diabetes from a very young age and he had been closely following them. This study lasted over a decade. His findings were that the most crucial factor for diabetic retinopathy was diastolic arterial hypertension and it was not microalbuminuria.[11]The incidence of diabetic retinopathy in this study was 39 (37.5%). The epidemiological factors implicated were diastolic arterial hypertension, duration of diabetes (displaying elevated levels of HbA1c) male sex. The incidence of microalbuminuria was 21 patients (20.2%).

A study from Spain reported that while microalbuminuria in Type 1 Diabetes Mellitus patients was a serious agent for diabetic retinopathy, its association with diabetic retinopathy was not found to be significant for type 2 Diabetes Mellitus.[12] The authors published different prevalence percentages for Type 1 and Type 2 diabetic patients. For those who suffered from Type 1 Diabetes Mellitus, their prevalence was 25.61 % and their nephropathy prevalence was 8.60 % while for those who suffered from Type 2 Diabetes Mellitus; their prevalence was 17.78% while their nephropathy prevalence was 6.74%. From this study it was concluded that serious risk factors for diabetic retinopathy were; arterial hypertension, insulin treatment in patients diagnosed with Type 2 Diabetes Mellitus, elevated levels of glycosylation followed by the time duration of diabetes.

In contrast to the study from France[11], a group of Iranian researchers conducted a cross-sectional study on 590 patients who were diagnosed with type 2 diabetes mellitus. The findings from the study were that microalbuminuria can be regarded as a definitive agent in the identification of patients with diabetic retinopathy.[13] Different prevalence percentages were recorded for retinopathy; predominantly it was 39.3% for 232 patients. 5.4% of them displayed characteristic properties of proliferative diabetic retinopathy (PDR). An inverse correlation was observed between diabetic retinopathy with the body mass index (BMI) (P = 0.02). Elevated levels of HbA1c were also recorded in patients with a PDR of a mean of 10.5% in contrast with patients that didn't exhibit any indications of retinopathy (Mean = 9.5%); this was statistically huge (P = 0.001) Based on the prevalence percentages; 25.9% was recorded for microalbuminuria while 14.5% of the patients' exhibited conditions of microalbuminuria. The culmination of all these studies has led to the conclusion that diabetic retinopathy, the renal aspects, and its involvement are significantly correlated in a positive manner. (P = 0.001)

Distinctive studies were conducted in India to research the correlation of diabetic retinopathy with different factors. They observed that microalbuminuria is in correspondence with diabetic retinopathy but in patients who are lean type 2 diabetic. Elevated excretion of urinary albumin correlated with the progression of proliferative diabetic retinopathy in lean patients; diagnosed with type 2 diabetes mellitus.[14] The study was conducted on 52 patients who were type 2 diabetic. it was observed that the patients who were diagnosed with diabetic retinopathy had a prolonged period of diabetes identified, in contrast with the patients who had a normal fundus; this resulted in an insignificant statistical difference. 63.6% of patients who were diagnosed with diabetic retinopathy had a fasting blood glucose level greater than 200 mg/dl while the same glucose levels were reported in 36.4% of the patients but they possessed a normal fundus. Patients that were diagnosed with diabetic retinopathy also tested positive for microalbuminuria and the level of microalbuminuria was considerably higher in patients who were diagnosed with proliferative retinopathy in contrast with the patients who had a background in retinopathy.

Recently an interesting study emerged from Nepal. They conducted research studies on diabetic patients who tested positive for microalbuminuria. They suggested that all patients be tested for retinopathy so that appropriate measures are taken for the prevention of their ocular morbidity.[15]

Different factors were reported in this study that significantly influenced the prevalence of retinopathy, they were; prolonged duration of diabetes in a person (P = 0.002), substandard measures in controlling their diabetes (P = 0.002), presence of hypertension (P = 0.03) and damage to the nerves such as peripheral neuropathy (P = 0.001) Some of the factors stood out and did not influence retinopathy they were; hyperlipidemia (P = 0.29), exposure to smoke (P = 0.43) and people who displayed obesity (P = 0.43)

CONCLUSION

The presence of microalbuminuria and hypertension significantly influence the progression of diabetic retinopathy. Patients diagnosed with diabetes should regularly be screened for the development of microalbuminuria and/or hypertension and these conditions are aggressively managed to lessen the precipitation of diabetic retinopathy.

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