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Prevalence and Risk Factors of Diabetic Nephropathy in Omani Type 2 Diabetics in Al-Dakhiliyah Region

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Abstract

Objective: To assess the prevalence and risk factors of diabetic nephropathy among Omani type 2 diabetics in Al-Dakhiliyah region of the Sultanate of Oman.

Methods: A cross-sectional and a case control study designs were used to assess the prevalence and risk factors respectively. For the prevalence study a sample of 699 diabetic subjects were selected randomly from two polyclinics in Al-Dakhiliyah region; Sumail and Nizwa polyclinics. For the case control study, a sample consisting of 215 cases and 358 controls were randomly selected from those who were included in the cross-sectional study. A well designed questionnaire has been used to collect data regarding the disease and risk factors. Data was analyzed using SPSS19 statistical program.

Results: Total prevalence of diabetic nephropathy was calculated as 42.5% (95% C.I: 38.83% - 46.15%). The difference in the prevalence in the two polyclinic catchment area was not significant. The prevalence was significantly higher among males (51.6%) compared to females (36.5%). Crude analysis of the risk factors showed significant association between diabetic nephropathy and the following factors; male gender, decreased literacy, long duration of diabetes mellitus, hypertension, retinopathy, neuropathy, family history of diabetic nephropathy, poor glycemic control (high HbA1c), and hypertriglyceridemia. Multivariate analysis showed the following factors to be independent risk factors; male gender, decreased literacy, long duration of diabetes, family history of diabetic nephropathy and poor glycaemic control (high HbA1c).

Conclusion: The prevalence of diabetic nephropathy in this study was 42.5% and the significant risk factors associated with it included male gender, decreased literacy, long duration of diabetes, family history of diabetic nephropathy and poor glycemic control (high HbA1c).

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Keywords: Diabetic nephropathy; Albuminuria; Type 2 diabetes; Omani; Prevalence; Risk factors.

Introduction

Diabetic nephropathy is one of the most serious long-term complications of diabetes mellitus (DM). Among all diabetes complications diabetic nephropathy is the diabetes specific complication with the greatest mortality.[1] DM is considered to be the main reason to start renal replacement therapy in many countries,[2] and has become the most common single cause of end-stage renal disease (ESRD) in the USA and Europe, as well as in many developed countries.[3,4]

Worldwide, the number of patients with diabetes receiving renal replacement therapy has doubled from 12.7 million in 1990-1991 to 23.6 million in 1998-1999.[5] Although type 1 and type 2 DM both lead to ESRD, the majority of patients are those with type 2, due to the much greater prevalence.[6,7]

Oman now has a total population of approximately 3.174 million,[8] of which 2.018 million are Omanis. The prevalence of DM is considered high (11.6%) in this country.[9] In 2000, the age-adjusted prevalence of diabetes among Omanis aged 30-64 years reached 16.1% compared with 12.2% in 1991, indicating an increasing prevalence.[10]

One published study could be found on diabetic nephropathy in Oman, conducted in 2005. It showed a prevalence of microalbuminuria of 27% and also found that HbA1c, serum creatinine and presence of hypertension were the most significant predictors for microalbuminuria.[11]

Data from the central dialysis center shows increasing incidence of diabetic nephropathy on dialysis.[12] Since type 2 DM is considered to be a major problem in Oman and limited studies have been conducted to evaluate the prevalence of diabetic nephropathy and its risk factors; this study was aimed to assess the prevalence and risk factors of diabetic nephropathy in Omani type 2 diabetics in Al-Dakhiliyah region.

Methods

In this study, two study designs were used; a cross-sectional design and a hospital based case control design in order to assess the prevalence and the risk factors respectively. The reference

population of this study was all Omani type 2 diabetics who are already diagnosed by diabetologists (based on the world health organization criteria) and following up their treatment in the Ministry of Health institutions in Al-Dakhiliyah region. We included Omanis only because almost all registered patients in the concerned health institutions are Omanis. In addition we want to study the above mentioned objectives in Omanis only to see the situation among this population on whom very limited studies were conducted regarding nephropathy.

Two polyclinics were selected for the study; Sumail and Nizwa polyclinics. For the prevalence study, a sample of 699 diabetic subjects, 220 from Sumail polyclinic and 479 from Nizwa polyclinic were selected as the diabetes population in Nizwa is nearly twice that of Sumail. The sample was selected by systematic sampling from a sampling frame maintained by the two polyclinics. For the case control study a total sample of 573 subjects, which consisted of 215 cases and 358 controls were randomly selected from those who were included in the cross-sectional study. The cases were selected from those who were diagnosed to have diabetic nephropathy in the period between 2006 and 2010 as the computerized information was available only from the year 2006 upward, while the controls were selected from those who were free from diabetic nephropathy till 2010. Participants with other causes of albuminuria, with incomplete diagnostics or those who refused to participate were excluded.

A well designed questionnaire has been used to collect data regarding the disease status and risk factors. All information was obtained from the diabetes register maintained by the centers as per guidelines of Ministry of Health and from the soft file of each patient through medical records. Also telephonic interviews were conducted to confirm or add any missing data.

Microalbumin/creatinine ratio was calculated after measuring urine albumin and creatinine. Immunoturbimetric method was used to measure urine albumin by a Japanese Hitachi instrument and colorometric method was used to measure urine creatinine. Urine samples from the two polyclinics were referred to the regional hospital where the test is usually performed. A case was diagnosed if 2 out of 3 consecutive tests were positive.

The study was approved by research ethics committee of the college of Medicine and Health Sciences, Sultan Qaboos University. Also an informed written consent was obtained from each participant prior to data collection. The study was conducted in the period between September 2010 and June 2011.

The data was entered in SPSS19 statistical program for analysis. Continuous variables were categorized according to standard criterions and descriptive statistics, univariate analysis and multivariate analysis were performed. Prevalence was calculated and the association between various risk factors and diabetic nephropathy was studied by chi-square test, odds ratio, independent t-test, Mann-Whiteny test and stepwise logistic regression.

Results

Results of the cross-sectional study showed total prevalence of diabetic nephropathy of 42.5% (with 95% confidence interval as 38.83% - 46.15%). The two polyclinic catchment areas were found to be similar in respect of diabetic nephropathy prevalence (Sumail- 43.2%, Nizwa- 42.2%). The prevalence was significantly higher among males (51.6%) compared to females (36.5%).

In the case control study sample, males constituted 38.2% of the study group, and the mean age was 51.86 ± 11.75.Socio-demographic characteristics of the cases and controls are shown in Table 1.

Table 1: Socio-demographic characteristics among cases and controls.

Characteristic	Category	Cases n (%)	Controls n (%)
Gender	Males	98 (45.6)	121 (33.8)
	Females	117 (54.4)	237 (66.2)
Age	20-30	8 (3.7)	15 (4.2)
	30-40	30 (14.0)	34 (9.5)
	40-50	46 (21.4)	95 (26.5)
	50-60	77 (35.8)	120 (33.5)
	60-70	37 (17.2)	74 (20.7)
	≥70	17 (7.9)	20 (5.6)
BMI	<25	44 (21.3)	79 (22.5)
	25-30	79 (38.2)	132 (38.9)
	≥30	84 (40.6)	128 (37.8)
Age at diagnosis of DM	20-30	14 (6.5)	25 (7.0)
	30-40	43 (20.0)	51 (14.2)
	40-50	79 (36.7)	122 (34.1)
	50-60	58 (27.0)	116 (32.4)
	≥60	21(9.8)	44 (12.3)
Literacy level	Illiterate / just literate	179 (87.3)	270 (79.2)
	School	19 (9.3)	43 (12.6)
	College or above	7 (3.4)	28 (8.2)

Crude analysis of the risk factors showed significant association between diabetic nephropathy and the following factors; male gender, decreased literacy, long duration of diabetes mellitus, hypertension, retinopathy, neuropathy, family history of diabetic nephropathy, poor glycemic control (high HbA1c), and hypertriglyceridemia. However, many factors that were found to be associated with diabetic nephropathy in the crude analysis were excluded by multivariate adjusted analysis as shown in the Table 2, indicating that their crude association was most probably due to other confounding factors.

Table 2: Crude and adjusted odds ratios for independent risk factors.

Characteristic	Category	Crude odds ratio(95% C.I), *p*-value	Crude p-value	Adjusted odds ratio(95% C.I), *p*-value	adj. *p* value
Gender	Males	1.6 (1.16 - 2.32) *p*=0.005	0.005	2.6 (1.56 - 4.26) *p*<0.001	<0.001
	Females	1.00		1.00	
Education Literacy Level	Illiterate / read and write	2.7 (1.13 - 6.20) *p*=0.024	0.032	6.9 (1.85 - 25.93) *p*=0.004	0.005
	School	1.8 (0.66 - 4.75) *p*=0.259		3.1 (0.73 - 13.21) *p*=0.126	
	College or above	1.00		1.00	
Duration of DM (years)	>5	1.00	<0.001	1.00	0.037
	5 - 10	2.1 (1.38 - 3.07) *p*=0.001		2.0 (1.16 - 3.52) *p*=0.014	
	10 - 15	2.1 (1.31 - 3.50) *p* =0.002		2.0 (1.04 - 3.84) *p*=0.037	
	≥15	3.3 (1.49 - 7.22) *p*=0.003		2.2 (0.86 - 5.72) *p*=0.099	
Family history of diabetic nephropathy	Present	2.1(1.03 - 4.25) *p*=0.041	0.037	2.8 (1.05 - 7.45) *p*=0.039	0.039
	Absent	1.00		1.00	
HbA1C at diagnosis	<7	1.00	<0.001	1.00	< .001
	7 - 8	1.5 (0.88 - 2.41) *p*=0.142		1.5 (0.83 - 2.78) *p*=0.180	
	≥8	3.4 (2.25 - 5.28) *p*<0.001		2.8 (1.61 - 4.86) *p*<0.001	

The multivariate stepwise logistic analysis showed that diabetic nephropathy was independently associated with; male gender, decreased literacy, longer diabetes duration, family history of diabetic nephropathy and poor glycemic control.

Discussion

The present study showed high rate of diabetic nephropathy (microalbuminuria and macroalbuminuria) as the calculated prevalence was 42.5% (95% C.I: 38.83 - 46.15). The prevalence of microalbuminuria in patients with type 2 diabetes varies with ethnicity, being higher in Asians and Hispanics than in Whites (43% *vs.* 33%).[13]

One earlier study conducted in Oman reported the prevalence of microalbuminuria as 27%.[11] However, that study did not include macroalbuminuria in its prevalence and only dealt with microalbuminuria, which may be the reason for the lower prevalence rate. Another reason for the lower rate in that study might be the difference in the diagnostic test used. In present study, we depended on microalbumin/creatinine ratio, and in the above study 24-hrs urine protein measurement was used.

A study conducted using a sample from 3 Gulf countries: Bahrain, UAE and Oman reported an overall albuminuria prevalence of 36%. The prevalence was 42.5% in Bahrain, 34.5% in UAE and 29% in Oman. The prevalence of the present study was similar to that of Bahrain.[14] Another study conducted in Bahrain showed an overall albuminuria prevalence of 42.3% which is again comparable to our result.[15] In addition, a high prevalence of albuminuria (52.8%) was reported in one of the studies conducted in Saudi Arabia which is high compared to our result.[16]

Studies conducted in neighboring Asian countries reported variability in the prevalence of microalbuminuria[16-23] ranging from 14.2% in Iran to 36.3% in India. Recently, the MAP study had shown the alarming high prevalence of albuminuria. The highest prevalence of microalbuminuria was observed in Korea (56.5%) and the lowest in Pakistan (24.2%).[24]

In the United Kingdom Prospective Diabetes Study,[25] the total prevalence of nephropathy was reported as 30.8%, which is lower than our results. While in other European countries, the total prevalence was observed as 47%.[26]

In the above mentioned studies the variations in the prevalence of albuminuria can be attributed to disparities in several factors such as; study design, source of study population, sample selection, race, age and sex structure of the study population, the definition of albuminuria and diabetic nephropathy, as well as the methods of measurement of albuminuria and urine collection, diabetic duration, and diabetic treatment, etc. As for risk factors, analysis showed that male gender is an independent risk factor for diabetic nephropathy. A strong association between male gender and diabetic nephropathy has repeatedly been reported in the literature.[15,19,22,27]

The present study showed that the age factor is not associated with diabetic nephropathy. This result was consistent with many other studies.[17,21,28] It seems that age is not important and what is important is the duration of diabetes. The multivariate analysis showed that the diabetes duration is an independent risk factor for diabetic nephropathy and this is consistent with most other related studies.[15,16,29-31]

The present study showed that the literacy status is an

independent risk factor for diabetic nephropathy. It showed that the risk for nephropathy increases as literacy decreases. Studies have shown that the highest percentage of type 2 nephropathy was found in patients with no school education and the lowest percentage was found in patients who had university level education.[32]

Low literacy as a component of low socio-economic status is well known to be associated with many chronic diseases. People with diabetes and low level of education have lower utilization rates of checks and services required for diabetes care; and therefore result in a worse outcome in terms of complications as reported by other studies.[33] In addition, patients with low literacy levels usually have less knowledge about treatment and importance of diabetic control as well as compliance to medication.

However, with the association between hypertension and diabetic nephropathy was established by most of the related studies,[25,34-36] the present study showed a conflicting result. It showed that the presence of hypertension was a significant risk factor for nephropathy by univariate analysis but not by multivariate analysis. The possible explanation for this conflicting finding in the present study may be the definition of hypertension. In this study, hypertension was considered if the patient was labeled in the file as hypertensive. Blood pressure of the subjects mentioned as non-hypertensive was not rechecked. It may be that a reasonable number of them were having HTN with nephropathy but could not be detected.

The present study also did not detect any association between retinopathy and nephropathy. Surprisingly in the present study, only 13.7% of all patients with diabetic nephropathy had concomitant retinopathy, which is less than expected. However, few studies reported low prevalence of retinopathy among nephropathic patients,[37,38] but their results were not as low as in the present study. Usually, retinopathy and other microvascular complications like neuropathy proceed the onset of nephropathy expecting strong association between them. A possible explanation for under reporting retinopathy in our results may be the difference in method and accuracy of diagnosing retinopathy. In our study, retinopathy was diagnosed by junior ophthalmologists using simple fundoscopy which may underestimate retinopathy in nephropathic patients.

The present study emphasizes the role of genetic predisposition to diabetic nephropathy through the significant association between positive family history of diabetic nephropathy and development of diabetic nephropathy. This is consistent with many related studies.[39-41] The likelihood of developing diabetic nephropathy is markedly increased in patients with a diabetic sibling or parent who has diabetic nephropathy; these observations have been made in both type 1 and type 2 diabetes.[42,43]

The present study results showed an independent association between diabetic nephropathy and poor glycemic control (high HbA1c). Poor glycemic control is a well-known risk factor for most diabetic complications, not only diabetic nephropathy. Most other related studies have reported similar results.[11,14,15,27,28,44]

However, diabetic nephropathy patients tend to have increased hyperlipedimia and have a tendency of premature atherosclerosis; however, no independent significant association was observed between dyslipidemia and diabetic nephropathy in the present study. Maybe because the patients were administered statins for dyslipidemia; therefore, this study did not find any relation between dyslipidemia and albuminuria.

Many limitations were encountered during this study. First, it was not possible to double the number of controls due to time limitations. Second, there is an area of missing data regarding some variables (e.g. smoking, retinopathy…etc.), which may have affected the results had they been available. Third, for some variables; we depended on the patient information which might have been influenced by recall bias. Also, we encountered difficulties in obtaining the actual age at onset of diabetes and hypertension. Another limitation was that renal biopsy which is the gold standard diagnostic investigation was not performed. Furthermore, obesity was defined using BMI in our study rather than waist circumference, which if measured would have correlated with albuminuria.

Conclusion

It was concluded that the prevalence of diabetic nephropathy in this study was found to be as high as 42.5%, alarming the health workers and decision makers to face this problem by anticipating the present and future needs of therapeutic and preventive measures. Male gender, decreased literacy, long duration of diabetes, family history of diabetic nephropathy and poor glycemic control (high HbA1c) were the significant associated risk factors. Diabetics should be educated about the modifiable risk factors especially those with high risk. Also this study should be taken as the basis for further research in order to elucidate the problem in greater detail.

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