AMJ Australasian Medical Journal [AMJ 2016;9(12):531–538]

Prevalence and risk factors of diabetic retinopathy in Saudi Diabetics in Majmaah City

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RESEARCH

Please cite this paper as: Alabdulwahhab KM. Prevalence and risk factors of diabetic retinopathy in Saudi Diabetics in Majmaah City. AMJ 2016;9(12):531–538. https://doi.org/10.21767/AMJ.2016.2783

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ABSTRACT

Background
Diabetes mellitus (DM) is one of the most common chronic diseases worldwide. Diabetic retinopathy (DR) is the most common complication of DM and it is the leading cause of blindness in the Kingdom of Saudi Arabia.

Aims
The study was conducted to determine the prevalence and risk factors of DR in patients with type II DM in Al Majmaah City, Saudi Arabia.

Methods
We conducted this cross-sectional study from February 2014 until May 2015. Out of the 1546 diabetic patients registered in the primary care centres of Majmaah city, a random sample of 327 patients were selected. An expert ophthalmologist took a detailed history and performed ophthalmic examination on all patients. Mean ± S.D was measured for quantitative variables. Frequencies and percentages were given for qualitative variables. Logistic regression was applied to associate DR with alleged risk factors.

Results
The prevalence of DR among the study group was 35.8 per cent. Non-proliferative diabetic retinopathy was prevalent in 31.8 per cent cases. We tested the association between DR and various risk factors. We found that patients, who develop DM when they were between 40 and 60 years, have more chance to develop DR.

Conclusion
DR is affecting more than one third of diabetic patients in Saudi Arabia. There is an urgent need to establish and promote national screening and management programs for DR. Delaying the onset of DM after the age of 60 may help to lessen that problem.

Key Words
Diabetic retinopathy, diabetes mellitus, prevalence, Majmaah, Saudi Arabia

What this study adds:

1. What is known about this subject?
The prevalence of DR among diabetics varies from country to country and from region to region in the same country. Many known risk factors of DR are already well studied.

2. What new information is offered in this study?
Prevalence of DR among diabetics in Majmaah city has been reported for the first time. The age of onset of DM is an important risk factor that has been identified in this study.

3. What are the implications for research, policy, or practice?
Screening and management programs of DR are needed urgently in KSA. Delaying the onset of DM may help to slow down the progression towards DR.

Background

Diabetes mellitus (DM) is one of the most common chronic diseases all over the world, and continues to increase in numbers and significance.[1] Saudi Arabia ranked third among

the top 10 countries for diabetes prevalence in 2010 and is estimated to keep that place till 2030.[1] Over the last decade, there has been dramatic increase in the prevalence of DM in Saudi Arabia, the last estimate is approximately 30 per cent.[2]

The most common complication of DM is diabetic retinopathy (DR) and in many developed countries, DR is the leading cause of new cases of visual impairment and blindness among adults aged 20–74 years.[3] DR is also considered to be the leading cause of blindness in the Kingdom of Saudi Arabia.[4] The estimated prevalence of DR was ranging from 20 to 30 per cent among US adults with diabetes.[5,6] Nearby countries reported DR prevalence to be from 12 to 20 per cent.[7–10] Since 1998, several studies have been carried out to find out the prevalence of DR in KSA, most of them were ranging from 20 per cent to 36 per cent.[4,11–18] All of these studies were conducted in large cities, no study was conducted in a small city, where it is the case of most of Saudi Arabia cities.

Investigating the prevalence of DR is important because it is a key indicator of systemic diabetic microvascular complications, and as such, a sentinel indicator of the impact of diabetes.[3,5] Several factors have been identified as determinants for the development of DR and its progression; including, type and duration of DM, age, gender, glycaemic control, hypertension, body mass index (BMI), smoking, serum lipids and presence of microalbuminuria (MA).[19,20] Major studies have shown that severe ocular complications and risk of vision loss due to diabetic retinopathy can be reduced or avoided through early diagnosis by regular eye examination and timely treatment and by effective control of serum glucose and blood pressure.[21] It is widely recommended that all persons with diabetes mellitus should be regularly screened for diabetic retinopathy. The efficacy and cost-effectiveness of early detection and treatment of diabetic retinopathy is well established.[22]

Method

This was a community based cross–sectional study, to determine the prevalence and risk factors of DR in patients with Type II DM in Al Majmaah city. Al Majmaah city is the capital of Al Majmaah governorate, one of Riyadh area governorates, in the middle of the Kingdom of Saudi Arabia covering 180 kilometres north of Riyadh city. The population of Almajmaah city is around 50,000 of which 35,500 are Saudi.[23] Diabetic patients in the city are registered at eight primary health centres (PHCs) and referred to one hospital, King Khalid Hospital. The study population was all Saudi adults, males and females, registered in the diabetic registry in all PHCs in Al Majmaah city (total number is 1546). The sample was selected from all PHCs proportional to the number of diabetics' registered using systematic random sampling technique. The selected patients were called by phone, and were directed to the eye clinic at the referral hospital for data collection. A sample size of 300 was calculated from the level of precision formula: $n = Z^2 * pq/d^2$. (Where, z = 1.96, p = 0.265, 1 – p = 0.735, d = 0.05). The prevalence of diabetic retinopathy was anticipated to be 26.5 per cent.[17] Data was collected from 327 diabetic patients in the period from February 2014 until May 2015, through a pre-defined questionnaire that is filled by the examining physician. The Cronbach alpha was (73.2 per cent). The questionnaire was divided into two parts. The first part comprised of demographic variables, risk factors, anthropometric measures, level of glycated haemoglobin (HbA1C) and use of DM medications. The second part comprised of detailed ophthalmic examination that was performed by an expert ophthalmology consultant.

The ophthalmic examinations comprised of; Visual Acuity (VA) measurements, which were taken, using Snellen distance vision screen; full slit lamp examination, which was performed using the Haag Streit Slit lamp and dilated fundal examination, which was performed with indirect ophthalmoscope and with +90-diopter Volk lens along with Slit lamp. We have used the international clinical diabetic retinopathy and diabetic macular oedema disease severity scales in the grading of DR.[24] Control of Diabetes was evaluated by the level of Hba1c. Body mass index (BMI) was measured and recorded. The other variables (Duration of DM and use of DM medications in addition to coexistence kidney and heart diseases, and hyperlipidaemia) were recorded by history. The presence of hypertension was considered if the patient confirms it or if measured blood pressure fits the World Health Organization definition of hypertension.[25]

Participants were divided into five groups based on age: Group 1 (30 years or less); Group 2 (31–40 years); Group 3 (41–50 years); Group 4 (51–60 years), and Group 5 (greater than 60 years). This study was approved by the Ethical Review Committee of Majmaah University. A written informed consent from the patients was taken before conducting the interview and examination. The data was entered and analysed using Statistical Package for Social Sciences (SPSS) 23.0. Mean $\pm$ S.D was measured for quantitative variables. Frequencies and percentages were given for qualitative variables. Logistic regression analysis was applied to observe the log odds. The results were

reported in adjusted odds ratio. A p-value of <0.05 was considered as statistically significant.

Results

A total of 327 patients with type II DM participated in the study, 61.4 per cent were males and 38.6 per cent were females. The mean age (± SD) was 54.95 ± 11.65 years. Majority of the participants (40.4 per cent) falls in the age group 4 (51-60 years), while, a small percentage of participants (3 per cent) were in group 1 (> 30 years). The percentages of participants in other age groups along with the other demographic characteristics of the sample are shown in Table1.

The overall prevalence of any stage of diabetic retinopathy in at least one eye among the study group was found to be 35.8 per cent (117 cases). NPDR was prevalent in 104 (31.8 per cent) and PDR was found in 13 (3.97 per cent) cases in at least one eye. Among the eyes with NPDR, the vast majority had mild NPDR (54.1 per cent), with rates of sever NPDR being 8.44 per cent. The proportion of DR patients with CSME was 37.6 per cent accounts for a prevalence of 13.5 per cent of the total sample. Fifteen (12.8 per cent) of DR patent has been treated with retinal laser.

Logistic regression analysis results presented in Table 2 shows factors that have significantly protective/contributing role towards diabetic retinopathy. The model overall correctly predicted 85.9 per cent of the cases. Males have more chances to develop DR as compared to females (OR=1.636, CI (1.172–2.647), p=0.045). Hypertensive patients are more likely to develop DR (OR=1.570, CI (1.214–2.551, p=0.032). In addition, Systolic BP as an independent variable is associated with more chance of DR development. Duration of DM, age and poor glycaemic control were contributing factors toward DR. Whereas, DR was not significantly associated with obesity, heart disease, hyperlipidaemia and kidney disease.

Patients with clinically significant macular oedema (CSME) were more likely to have other signs of DR (OR=3.890, CI (1.391–10.880), p=0.010). Two third of patients using insulin have developed DR while only one quarter of patients using OHG have developed DR. Logistic regression analysis showed that those who are using insulin were more likely to have DR Than others (OR=2.833, CI (1.027–7.814), p=0.044). Patients who develop DM when their ages were between 40 and 60 years, were more prone to have DR than others, irrespective of duration of DM (P=0.008).

Discussion

Almajmaah City represents most of Saudi Arabia cities, population and area wise. That is why we think that it is a good example of the country and the results that we got could be generalized to most of the Saudi Arabia population. By reviewing the literature, the DR prevalence in Saudi Arabia was first studied in 1998 by El-Asrar et al.[11] since then and over 18 years, 8 more papers has been published tackling the prevalence of DR and its risk factors in Saudi Arabia. These studies took place in large cities, while our study is conducted in a small to medium sized city, which may help in exploring the trend of DR in like these cities. Our study was community based in which all DM patients were examined in a fully equipped ophthalmic clinic by one board certified ophthalmology consultant, which was not the case of the previous studies, making better accuracy and uniformity of DR diagnoses and grading. In our study, we found the overall prevalence of any stage of diabetic retinopathy in at least 1 eye to be 35.8 per cent (117 cases). It is similar to that reported by most of the studies carried out in Saudi Arabia Abu El-Asrar[11] (31.3 per cent), Ataur Rahman Khan[14] (30 per cent), Al Ghamdi AH[15] (36.8 per cent), Mohamed F El-Bab[16] (36.1 per cent), and relatively close to Saad Hajar[17] (27.8 per cent). It is also almost similar to the global estimate of (34.6 per cent) in the study of Yau et al where they analysed 35 studies from all over the world.[26] Our result is similar to what has been reported in a recent study from the UK [(27)] (30.1 per cent) and not far from 2 studies from united state (28.2 per cent and 28.5 per cent).[28,29] Our result is higher than what was reported by 2 studies carried out in Saudi Arabia, where DR prevalence was (19.7 per cent) in Al-Rubeaan K[4] study and (16.7 per cent) in Alwakeel JS[13] study, It is also higher than a recent study from the US (21.7 per cent).[6] In this study, the prevalence of DR was higher than the prevalence reported in other Arabian Gulf countries, that is Kuwait (12 per cent)[8], and UAE (19 per cent).[30] There are also lower DR prevalence reports from other parts of the world like Pakistan.[9] However, our reported DR prevalence is lower than what has been reported in some nearby countries like Kuwait (40 per cent)[31] and Pakistan (43 per cent).[10] The differences in the reported prevalence of DR in previous studies may be attributed to the differences in studied population from ethnic groups and age perspective, in the addition the differences in study methodology and sampling technique. Accuracy of diagnosing DR and grading it is also a big variable. Nevertheless, in Saudi Arabia it seems that one third or more of diabetics have already developed DR. Keeping in mind the high prevalence of DM and the shortage of ophthalmologists outside main cities, calls for an urgent attention to overcome this problem by adopting a

national screening program that uses the recent technology like Non-Mydriatic Fundus cameras and training the PHC physicians to use them.

In our study, NPDR accounts for (88.9 per cent) of DR cases, making its prevalence to be (31.8 per cent) out of the total diabetic population. This is higher than what was reported by Al-Rubeaan K[4] (9.1 per cent) and Alwakeel JS[13] (11.4 per cent) from Saudi Arabia which could be explained by the lower DR prevalence in these two studies. In a recent study in the US the majority (94.1 per cent) of persons with DR had background DR[6], which is somewhat similar to our result.

PDR in our study accounts for 11.1 per cent of DR patients with a prevalence of 3.97 per cent which is much lower than what Al-Rubeaan K[4] reported (10.6 per cent) probably due to the nature of his study of being a national based registry where the diagnoses was made by physicians from all over the country where accuracy is not guaranteed. Our result is near to what has been reported recently in UK (2.9 per cent).[27]

Macular oedema prevalence in our study was 13.5 per cent which is near to (10 per cent) reported from the US in a recent study[6] and we found that patients with macular oedema (CSME) were more likely to have other signs of DR. This indicates the high demand for early intervention in DR patients when treatment can prevent vision loss.

Our study clearly demonstrates that increased duration of diabetes is associated with a higher prevalence of DR, which is a well-established risk factor in the literature.[6,27] We noticed that the prevalence of DR was increasing with the increase of age that could be partly due to age and partly due to longer diabetes duration. This also was found by other studies in Saudi Arabia[4,14,16] and elsewhere.[33] By analysing our results we found that patients who developed DM when their ages between 40 and 60 years have more DR prevalence than those who are younger or older irrespective of duration of DM. This may point out that the age of DM onset is by itself an independent risk factor. This fact is supported by Tanuja et al observation, where they found out that the prevalence of DR was maximum (35.7 per cent) when the age of onset was in the 41–50 age group.[32] It is also partly supported by the result of Wong et al[33] where they concluded that early onset of type 2 diabetes is an independent risk factor for the development of diabetic retinopathy, although their lowest age interval starts from 45 years, which prevent them from differentiating younger ages like those under 30 years, where we and Krakoff et al found a reduced risk of retinopathy development if type 2 DM starts before 30 year[36].

In the findings of Wisconsin study[35] and the observation by Al-Rubeaan[4] BMI was significantly lower in DR patients compared with patients with no DR. In our study and other study from KSA there was no statistically significant association between BMI and DR.[14]
Our findings showed that Females are less likely to develop DR as compared to males, this has been observed by Al-Rubeaan K[4] from Saudi Arabia, and inconsistent with reports elsewhere.[7,36] Other studies found women had significantly higher rates of diabetic retinopathy than men.[14] While further studies have found no differences in diabetic retinopathy according to gender.[37] This may suggest that merely gender is not a real risk factor.

Poor glycaemic control is a well-established risk factor for DR that has been reported in many large studies, like The Diabetes Control and Complications Trial (DCCT)[38] and the United Kingdom Prospective Diabetes Study[36] and other studies worldwide.[7,35] In agreement with that, our study and others carried out in SA support that.[4, 14-16]

DR was associated with insulin therapy more than OHG use in our study, the same finding was found by Abu El-Asrar[11] and Al-Rubeaan K[4] in SA, likewise 2 other recent studies from the UK[27] and USA[6]. This could be a reflection of the DM severity and control that increases the risk of DR, not insulin treatment itself.

Hypertension is found to be a significant risk factor for DR in many studies[4,7] around two thirds of DR cases in our study were hypertensive with significant association with DR. In addition, we found a strong association between increase systolic blood pressure and the presence of DR which is in consistence with studies carried out in the US[29,35,36] so the control of hypertension could help in delaying DR.

In our study, we did not find any significant relation between DR and history of dyslipidaemia, kidney disease and heart disease although, an association was reported by other studies in SA and nearby countries.[4,7] This may be because our results were based on history by patients with high loss rate, and due to the low frequency of the later tow in our sample.

Limitation of our study is that there may be some diabetic patients living in the city but not registered in the PHCs registry, and this could happen if some diabetics do not

follow in PHCs, rather they follow directly with the hospital for DM complications, or if the list was not updated.

Conclusion

On conclusion, DR in SA is now affecting more than one third of diabetics making it a huge medical problem facing medical planer where screening and management programs are needed urgently. Delaying the onset of DM after the age of 60 along with good glycaemic and blood pressure control may help to lessen that problem.

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ACKNOWLEDGEMENTS

The author gratefully acknowledges the Deanship of Scientific Research, Majmaah University, Majmaah, Kingdom of Saudi Arabia in funding this work. The author thanks Khaled Etohami, MD for assistance with sample recruitment, and Mr. Sami Waqas and Mr. Gopikrishnan for their grate help in technical support and statistical analysis. I am also immensely grateful to Alkhenizan Abdullah, MD for his comments on an earlier version of the manuscript.

PEER REVIEW

Not commissioned. Externally peer reviewed.

CONFLICTS OF INTEREST

No competing interests.

FUNDING

This research was funded by Deanship of Scientific Research Majmaah Univerity, Kingdom of Saudi Arabia.

ETHICS COMMITTEE APPROVAL

This study was approved by the Ethical Review Committee of Majmaah University. MRIEC07/BHSRC1084/20l3

Tables

Table 1: Demographic Characteristic of study sample

Characteristic		All cases with DM*	Cases with DR†
		n (%)	n (%)
Total		327 (100)	117 (35.8)
Age (mean ± SD‡) (y)		54.95 ± 11.65	57.47 ± 9.70
Age at DM diagnoses (mean ± SD) (y)		44.03 ± 12.1	42.26 ± 10.3
Duration of DM (mean ± SD) (y)		11.14 ± 7.83	15.7 ± 7.45
Gender	Male	201 (61.4)	81 (69.2)
	Female	126 (38.6)	36 (30.8)
Age groups (y)	< 30	10 (3)	0 (0)
	31-40	23 (7)	5 (4.3)
	41-50	76 (23.3)	24 (20.5)
	51-60	132 (40.4)	54 (46.2)
	>60	86 (26.3)	34 (29.1)
Duration of DM (y)	<5	76 (23.2)	7 (6)
	5 - 10	112 (34.3)	24 (20.5)
	>10	139 (42.5)	86 (73.5)
Medications	Not taking medication	11 (3.4)	1 (0.9)
	OHG§	232 (71)	61 (52.1)
	Insulin	84 (26)	55 (47)

* DM – Diabetes Mellitus, † DR – Diabetic Retinopathy, ‡SD - Standard Deviation, § OHG – Oral Hypoglycemic Agents

Table 2: Binary logistic regression analysis using backward conditional approach for factors associated with Diabetic Retinopathy

Characteristic	Adjusted Odds Ratio	P-Value	95% CI[€] for Odds	
			Lower	Upper
Age	1.031	0.005	1.009	1.053
Gender	1.636	0.045*	1.172	2.647
HbA1c†	2.332	0.001*	1.923	2.732
Duration of diabetes	1.12	0.005*	1.035	1.212
Hypertension	1.570	0.032*	1.214	2.551
Systolic BP‡	1.012	0.046*	1.002	1.23
Diastolic BP	0.998	0.85	0.974	1.022
Insulin use	2.833	0.044*	1.027	7.814
Heart Disease	0.978	0.956	0.444	2.154
Cholesterol	1.338	0.250	0.814	2.200
Kidney Disease	1.791	0.286	0.614	5.221
BMI§	0.98	0.237	0.949	1.013
CSME**	3.89	0.010*	1.391	10.88

[€]CI – Confidence Interval, †HbA1c – Glycosylated Hemoglobin, ‡BP- Blood Pressure, §BMI – Body Mass Index, CSME – **Clinically Significant Macular Edema.