

# Awareness of eye complications and prevalence of retinopathy in the first visit to eye clinic among type 2 diabetic patients

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## Abstract

• **AIM:** To assess the awareness of eye complications and the prevalence of retinopathy, in the first visit to eye clinic, among type 2 diabetic patients attending a tertiary medical centre in Kuala Lumpur, Malaysia.

• **METHODS:** An investigator-administered questionnaire was given to 137 patients with diabetes undergoing first time eye screening in the eye clinic. This was followed by a detailed fundus examination by a senior ophthalmologist to assess for presence of retinopathy.

• **RESULTS:** Almost 86% of respondents were aware of diabetic eye complications, especially in patients who had achieved tertiary educational level (96.3%). The majority of the patients (78.8%) were referred by their physicians and only 20.4% came on their own initiative. Many of the patients (43.8%) did not know how frequent they should go for an eye check-up and 72.3% did not know what treatments were available. Lack of understanding on diabetic eye diseases (68.6%) was the main barrier for most patients for not coming for eye screening earlier. Despite a high level of awareness, only 21.9% had recorded HbA<sub>1c</sub> level of <6.5% while 31.4% were under the erroneous assumption of having a good blood sugar control. A total of 29.2% had diabetic retinopathy in their first visit eye testing.

• **CONCLUSION:** In the present study, 29.2% of type 2 diabetic patients had retinopathy in their first time eye testing. Although the awareness of diabetic eye complications was high among first time eye screening patients, the

appropriate eye care-seeking behavior was comparatively less and should be rectified to prevent the rise of this sight threatening eye disease.

• **KEYWORDS:** diabetic retinopathy; eye complications; awareness; eye screening

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## INTRODUCTION

There are about 280 million diabetic patients worldwide which is estimated to double by 2025. It has been predicted that more than 30% of the global number of people with diabetes in 2025 will be in the Asia Pacific region<sup>[1]</sup>. In Malaysia, diabetes is a growing concern. Results of the two National Health and Morbidity Surveys (NMHS) showed a dramatic increase in the prevalence from 8.3% in 1996 to 14.9% in 2006 for Malaysian adults aged 30 years and above-an increase of 80% over a period of just 10 years<sup>[2]</sup>. The complications associated with diabetes are appalling. It is estimated globally that about 15 000 to 39 000 people lose their sight because of diabetes and about 14.6% aged 40 years and above, developed diabetic retinopathy after a 5-year duration of diabetes<sup>[2]</sup>.

Retinopathy is the most common eye disease in diabetes and is caused by changes in the blood vessels of the retina. It is increasingly becoming a major cause of blindness throughout the world in the age group of 20-60 years<sup>[3,4]</sup>. In Malaysia, diabetic eye disease is the commonest cause of visual loss in the adult working age group<sup>[5]</sup>. The prevalence of diabetic retinopathy in Malaysia has been reported to progressively rise from 44.1%<sup>[6]</sup> in a 1981 study to 48.6%<sup>[7]</sup> in a 1996 study to 51.6% in a 2005 study<sup>[8]</sup>. The prevalence of diabetic retinopathy in this country is also much higher than the figures reported from U.K. (22.7%)<sup>[9]</sup>, Australia (32.0%)<sup>[10]</sup> and Japan (39.6%)<sup>[11]</sup>.

Due to the social disease burden and subsequently the economic implication as a result of the diabetic eye disease,

a high level of awareness is needed to educate diabetic patients with regards to this debilitating complication. A previous study assessing the awareness of diabetes complications in Australia found that only 37% of the diabetic population were aware of the association between diabetes and eye disease [12], whereas a study from the U.S. found that 65% of people with diabetes were aware of the association between diabetes and eye disease [13]. In a study of an urban general population in India where the prevalence of diabetic retinopathy was high, Dandona *et al* [14] observed a low level (27.0%) of awareness about this dreaded complication.

Nonetheless, little has been reported on awareness of eye complications and the retinopathy changes among diabetic patients in Malaysia despite the apparent increase of retinopathy in the population. The purpose of this article is to assess the level of awareness and the perceived barriers to eye care for diabetic eye disease among the urban diabetic patients undergoing a first time eye screening in a large tertiary care medical centre in the capital city of Kuala Lumpur, Malaysia.

### MATERIALS AND METHODS

**Subjects** A total of one hundred and thirty-seven diabetic patients who underwent first time eye screening in the eye clinic of University of Malaya Medical Centre (UMMC), from October 2009 to December 2009, were included in this cross sectional study. The research protocol was approved by the University of Malaya ethics review board and followed the tenets of the Declaration of Helsinki.

### Methods

**Data collection** After informed written consent was obtained from the patients, basic demographic data regarding age, gender, race, education level and occupation of the patients was recorded. From the patients' medical records, the type of diabetes, duration of diabetes, type of medication, the blood glucose stability as well as most recently recorded HbA<sub>1c</sub> and any other medical history including presence of hypertension, hypercholesterolaemia and ischaemic heart disease were noted. Good blood sugar control was taken as HbA<sub>1c</sub> levels of <6.5% over a period of 3 months.

The patients were then asked to respond to a 11-point questionnaire before their first eye examination in the eye clinic. The questionnaire included specific questions regarding awareness and knowledge of diabetes complications especially retinopathy, eye screening and appropriate eye care-seeking behavior. A guideline for the preparation of the questionnaire was obtained after a detailed search in the literature on previous published reports of knowledge and awareness of diabetic retinopathy for a study population [15-17]. The questionnaires were administered by a

trained bilingual interviewer well versed in both English and Malay language, the national language. Before commencing the study, the questionnaire was pre-tested in a sample group of diabetic patients attending the eye clinic for the first time and based upon the responses given necessary modifications were made to enhance comprehension. Some of the questions were in the format of 'yes', 'no' and 'do not know' while others had a few answers whereby the patients were asked to choose their best response. A sample of the questions related to diabetes knowledge and its complications is shown in Table 1.

**Eye examination** After completion of the questionnaire, each patient had their visual acuity recorded using the Snellen chart. All patients underwent a detailed fundus examination using slitlamp biomicroscope by the attending ophthalmologist in the eye clinic. Fundus photographs were taken for everyone and the presence or absence of diabetic retinopathy was recorded.

Retinopathy status was based on the definition used by Diabetic Retinopathy Study (DRS) and Early Treatment Diabetic Retinopathy Study (ETDRS) [18].

1 Nonproliferative diabetic retinopathy: Mild (one or more microaneurysm), moderate (microaneurysm, dot and blot hemorrhage, cotton wool spot, venous beading, arteriolar narrowing, intraretinal microvascular abnormalities) and severe (all of the moderate stage plus any one of the following three findings: blot hemorrhage in 4 quadrants, venous beading in 2 quadrants, IRMA in 1 quadrant).

2 Proliferative diabetic retinopathy: Early (NVD or NVE); and High risk (NVD > 1/4 disc diameter/ NVD < 1/4 disc diameter plus vitreous hemorrhage/ NVE > 1/2 disc diameter plus vitreous hemorrhage).

3 Macular edema: early (retinal thickening / hard exudates within 1 disc diameter from the fovea) or Clinically significant macular edema (CSME) (retinal thickening or edema less than 500 microns from the fovea, hard exudates less than 500 microns from the fovea with retinal thickening or retinal thickening greater than 1500 microns with any part of it lying within 1500 microns from the fovea).

4 Maculopathy: exudative or ischemic

**Statistical Analysis** Statistical analysis was performed with SPSS v 12 (SPSS Inc; Chicago, IL, USA). Determinants of knowledge on diabetes and diabetic retinopathy such as gender, age, race and education level were analyzed between the groups using univariate analysis (Chi-square test).  $P < 0.05$  was considered statistically significant.

### RESULTS

**Demographic Characteristics** One hundred and thirty seven first time diabetic eye screening patients comprising of 67 males and 70 females were interviewed in the study. The age of patients ranged from 32-81 years old, with the mean

**Table 1 Questionnaire related to diabetes, diabetic eye diseases and appropriate eye care-seeking behavior**

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1 Are you aware that diabetes can affect the eye? ..... Yes/ No  
 2 How good do you think your blood sugar control is? ..... Good/ Not good  
 3 Can individuals with controlled diabetes have eye problems? ..... Yes/ No  
 4 Does a diabetic patient need to have eye checkup when his/her blood sugar level is well-controlled? ..... Yes/No  
 5 Does a diabetic patient need to have eye checkup when his/her blood sugar level is poorly-controlled? ..... Yes/No  
 6 Which of the following complication/s may arise if diabetes is poorly controlled?  
     Coronary artery disease ..... Yes/No/Do not know  
     Stroke ..... Yes/No/Do not know  
     Peripheral vascular disease ..... Yes/No/Do not know  
     Neuropathy ..... Yes/No/Do not know  
     Eye Disease ..... Yes/No/Do not know  
     Nephropathy ..... Yes/No/Do not know  
 7 How did you come to know about this/these complication/s?  
     Doctor/nurse/ophthalmologist/optometrist  
     Family member/friends/relatives with diabetes  
     Television/radio/newspaper/internet  
 8 How frequently should a person with diabetes undergo an eye checkup?  
     Every 6 months  
     Yearly  
     Two yearly  
     Only when vision affected  
 9 Do you know what are the treatments available for diabetic retinopathy?  
     Good control of diabetes alone is adequate  
     Laser treatments  
     Surgery  
     Do not know  
 10 What are the reasons that make you undergo first eye screening?  
     Doctor's referral  
     Self-awareness  
 11 What do you think was the biggest barrier for not getting eye screening earlier?  
     Lack of knowledge on diabetic eye disease  
     Lack of access to eye care  
     Cost/insurance issue  
     Time limitations  
     Fear of discovering something bad

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age of 57.5 years. All the patients had type 2 diabetes mellitus. The breakdown of the ethnicity and other demographic characteristics is shown in Table 2. Out of 137 patients, 30 (21.9%) of them had good blood sugar control at HbA<sub>1c</sub> level of <6.5% whereas 107 (78.1%) patients had poor control at levels higher than 6.5%.

The majority of patients were first diagnosed to have diabetes between 51-60 years old (45,32.8%). The highest number of patients with diabetic retinopathy fell in the age group of 61-70 years old (15,37.5%), followed by 13 (32.5%) patients in the range of 51-60 years old. The mean age of the patients when first diagnosed with diabetic retinopathy (58.72 years) was only slightly higher than those without diabetic retinopathy at first time eye screening (57 years). The number of male patients (22, 32.8%) diagnosed with diabetic retinopathy was higher than female patients (18, 25.7%). The prevalence of diabetic retinopathy was almost similar among the three main ethnics (Table 2).

**Awareness of Diabetes Mellitus and Its Complications**

Based on their medical records, even though only 21.9% of the patients had recorded HbA<sub>1c</sub> level of <6.5%, 48.9% of them thought that they had good blood sugar control on

questioning. About 31% of them were under the wrong impression of having good control while objectively they did not have good control. Eight patients (5.8%) had no idea at all about the complications that might arise if diabetes was poorly controlled. Among all the complications of diabetes, knowledge was highest towards diabetic retinopathy (86.1%), followed by peripheral vascular disease (80.3%), diabetic nephropathy (78.8%), diabetic neuropathy (78.1%) as well as coronary artery disease (74.5%). Knowledge about cerebrovascular accidents or stroke was the lowest (69.3%) among the complications of diabetes. Regarding the complications of diabetes, 52.6% of the patients interviewed claimed to know of them through their general practitioners, physicians or nurses. Another 21.9% got their information from the mass media such as television, radio, newspaper, magazines or internet and a further 25.5% obtained the information from family members, friends or relatives who suffered from diabetes.

**Awareness of Diabetic Retinopathy**

The vast majority of the patients (118, 86.1%) were aware that diabetes could affect the eye compared to 13.9% who were not. There was equal number of male (59, 50%) and female patients (59,

## Eye complications and prevalence of retinopathy

**Table 2 Demographic characteristics and other variables in patients with diabetic retinopathy**

Characteristics	Number	Patients with Retinopathy (%)
Gender		
Male	67	22 (32.8%)
Female	70	18 (25.7%)
Age group		
21-40	13	2 (15.4%)
41-60	61	20 (32.8%)
>61	62	18 (29.0%)
Race		
Malay	42	13 (30.9%)
Chinese	42	13 (30.9%)
Indian	51	13 (25.5%)
Others	2	1 (50.0%)
Duration of diabetes		
Less than 5 years	73	13 (17.8%)
6-10 years	23	5 (21.7%)
11-20 years	28	13 (46.4%)
More than 20 years	13	9 (69.2%)
Dyslipidemia		
Absent	54	19 (35.2%)
Present	82	21 (25.6%)
Hypertension		
Absent	59	16 (27.1%)
Present	78	24 (30.8%)
Ischaemic heart disease		
Absent	83	24 (28.9%)
Present	52	15 (28.8%)
Education level		
Illiterate	14	4 (28.6%)
Primary	37	13 (35.1%)
Secondary	59	17 (28.8%)
Tertiary	27	6 (22.2%)

50%) who were aware of the diabetic eye complications. The highest level of awareness was among the Indians (45, 38.1%), followed by the Malays (36,30.5%), the Chinese (36,30.5%), and other ethnic (1,0.8%). However, awareness of eye diseases was not significantly correlated with gender and race.

The level of awareness was found to be significantly associated with the patients' educational level ( $P<0.05$ ). Patients who had achieved tertiary educational level had the highest level of awareness of diabetic eye complications (96.3%) while illiterate interviewees showed the least percentage of awareness (64.3%) of diabetic retinopathy (Table 3).

Interestingly, patients with good blood sugar control showed a higher level of awareness (85.1%) as compared to those with poor blood sugar control (14.9%), although this was not significantly associated.

**Table 3 Association between educational level and awareness of diabetic eye complications**

Educational Level	Awareness of diabetic eye complications	
	Aware	Not aware
Illiterate	<sup>a</sup> 9 (64.3%)	5 (35.7%)
Primary	31 (83.8%)	6 (16.2%)
Secondary	52 (88.1%)	7 (11.9%)
Tertiary	<sup>a</sup> 26 (96.3%)	1 (3.7%)

<sup>a</sup> $P<0.05$

Among the 118 patients out of 137 interviewed who were aware of diabetic eye complications, about a third (30 patients) had signs of retinopathy. On the other hand, out of the remaining 19 patients who had not heard of diabetic retinopathy, almost half of them (10 patients) had retinopathy.

**Appropriate Eye Care –seeking Behavior** Even though the awareness of diabetic eye complications was high, 51.1% of the respondents were under the opinion that individuals with controlled diabetes status would not have eye problems. About a third (35%) thought that they could still have eye problems despite of controlled diabetes status and the remaining 13.9% were unsure about this.

The vast majority of the interviewees (91.2%) knew that they should visit an ophthalmologist when their blood sugar was poorly controlled. On the other hand, only 67.2% of the patients thought that they should still visit the eye specialist even when the blood sugar control was good. 3.6% of the patients were unsure if they should have an eye examination at all.

Despite the high level of awareness towards diabetes retinopathy among the interviewees, the majority of them (78.8%) came for first time eye screening after being urged by their physicians to get an eye exam. Only 20.4% of them came on their own accord.

A total of 43.8% of the patients did not know how frequently they should have an eye exam. About 14% of them thought that they should make a visit annually while another 21.9% thought that they should get their eyes checked only when they had problems with their vision. Another 19% thought that they should come once every six months and 1.5% deemed that visiting eye clinic once every two years was appropriate.

Interviewees predominantly chose to approach an ophthalmologist in the event of any eye problems (73.9%), less often to a non-ophthalmologist or general physicians (11.2%) and least likely to an optometrist (0.7%). Nonetheless, 14.2% of patients did not know which healthcare professional to approach. The awareness of eye diseases was significantly correlated to the choices of healthcare professional ( $P<0.005$ ). Among those who were aware of diabetic retinopathy, 81.4% chose to visit

ophthalmologists while 60.0% who did not know the complication had no idea whom to approach.

Although 118 (86.1%) patients were aware of diabetic retinopathy, 99 out of total 137 patients (72.3%) did not know what treatments were available. 13.9% knew that argon laser could treat retinopathy whilst 8% thought that achieving good control of diabetes would be enough to cure it. A smaller group of patients (5.8%) were under the impression that only eye surgery could help in treating diabetic retinopathy.

Lack of understanding on diabetic eye disease was the main barrier for most patients (68.6%) for not coming for diabetic eye screening previously. 18.2% did not come for eye check-up in UMMC as they already had eye screening at other healthcare providers. Other reasons for not getting eye screenings were lack of access to eye care (5.1%), time limitations (4.4%), cost or insurance issue (2.9%) as well as fear of discovering something bad (0.7%).

A total of 40 patients (29.2%) had retinopathy on first screening examination. The majority of the diabetic retinopathy changes detected were non-proliferative retinopathy followed by proliferative retinopathy. Only 7 patients (5.1%) were diagnosed with maculopathy concurrently with the retinopathy changes (Table 4). The duration of diabetes was significantly associated with the severity of diabetes retinopathy. The highest percentage of non-proliferative (20%) and proliferative retinopathy (40%) were seen in patients with duration of diabetes more than 20 years ( $P<0.005$ , Table 5). Indians had the highest percentage of proliferative retinopathy (30.6%).

## DISCUSSION

In Malaysia, a steady increase in the number of diabetic patients is a growing concern. There were 942 200 diabetic patients in year 2000, which increased to 2 481 443 in year 2003. With the reported prevalence of diabetes as 14.9% [2] and the current estimated population of 27 million, the total number of diabetic sufferers would approximately be 4 million and is expected to rise further due to ongoing industrialization and modernization of the nation. Therefore there is an urgent need to increase awareness and knowledge of diabetes and its complications especially of vision-threatening diseases.

In this study, 86.1% of the respondents were aware that diabetes could affect the eye, which was slightly higher than 83.5% from the previous study done among academic staffs (non-medical faculties) of University Malaya in 2004 [19]. This study also showed a higher percentage of awareness compared to study from India (37.1%) [15], Australia (37%) [12] and U.S. (65%) [13]. The majority of our study population (78.8%) had been referred by doctors to come for first time eye check-up. Thus, they usually had been informed about eye complications of diabetes prior to coming for eye

**Table 4 Distribution of different types of retinopathy in 137 first time diabetic eye screening patients**

Types of diabetic retinopathy	Number	Percentage (%)
Absent	97	70.8
Non-proliferative retinopathy	35	25.5
Proliferative retinopathy	5	3.6
Maculopathy	7	5.1

**Table 5 Association between duration of diabetes and retinopathy**

Duration of diabetes	Types of diabetic retinopathy		
	Absent	Non-proliferative retinopathy	Proliferative retinopathy
<5 years	60(61.9%)	13(37.1%)	0(0%)
6-10 years	18(18.6%)	4(11.4%)	1(20.0%)
11-20 years	15(15.5%)	11(31.4%)	2(40.0%)
>20 years	4(4.0%)	<sup>a</sup> 7(20.0%)	<sup>a</sup> 2(40.0%)

<sup>a</sup> $P<0.005$

examination. This might be one of the reasons to explain the high level of awareness in this study.

Looking at the factors contributing to awareness of diabetic eye complications, the highest percentage (96.3%) was seen in patients who had achieved tertiary educational level ( $P<0.05$ ). This significant correlation supports the proposition that education is important in creating awareness. Similar findings were noted from a study in India that showed that people with the highest level of literacy had better knowledge of diabetes and retinopathy [15]. Nevertheless, there was no significant association between awareness of eye complications and race, gender, blood sugar control as well as presence of retinopathy.

In this study, 48.9% of the patients were under the impression that they had good blood sugar control while objectively only 21.9% of them had so. This fact had been recognized in a national audit done by the Institute of Health Management at hospitals throughout Malaysia that revealed only 10.5% of diabetic patients on follow-up were under control, going by both HbA<sub>1c</sub> and fasting blood sugar results [20]. In this study also, half of the respondents were of the opinion that individuals with controlled diabetes would not have eye problems. This presumption of having a good blood sugar control when it is not detrimental to a diabetic patient's long-term outcome.

The vast majority of the interviewees in this study (91.2%) knew that they should visit an ophthalmologist when their blood sugar was poorly controlled. Nevertheless, lesser proportion of patients (67.2%) was under the correct impression that routine eye check-ups are still necessary in spite of good sugar control. This was slightly higher compared to a study in South India which showed 50.8% of the patients knew that routine eye checkups are necessary in spite of good control of DM [16].

In spite of the high level of awareness among the first time eye screening patients, a large majority (78.8%) came due to doctor's referral whilst only 20.4% of the interviewees came on own initiative. Previous study from Ireland revealed that the most significant predictor for receiving screening was a previous physician recommendation about the necessity of a regular eye examination [21]. This fact emphasizes the role of primary care physicians in our country in raising the awareness of eye complications in diabetic patients as some patients were ignorant regarding this matter. Besides, 43.8% of the respondents in our study did not know the frequency of eye check-up and this finding was worrisome especially when compared to the earlier study from India [15], which showed that over 90% of individuals were aware of the importance of regular eye examinations.

The awareness of eye diseases was significantly correlated to the choices of healthcare professionals ( $P < 0.005$ ). Among those who were aware of the complication, 81.4% preferred to visit ophthalmologists while 47.4% who were not aware of the complications had no idea who to approach. This shows a similar trend with the other previous studies that suggests raising awareness would help in accessing to healthcare [15-17,19,21].

The main barrier for most patients for not coming for diabetic eye screening in UMMC previously was lacking of understanding on diabetic eye disease. Among those who were aware the complications of diabetes, 52.6% came to know through general practitioners, physicians or nurses and 21.9% from mass media such as television, radio, newspaper, magazines or internet. A study from UK showed that verbal information from specialist nursing staff in the diabetes centre was most used and preferred as a source of information [22]. This highly suggests that more health education by trained professionals as well as aggressive health campaigns promoted via the media regarding diabetic eye complications could help in dispersing information regarding this potentially blinding disease. Our study showed that the awareness of diabetic eye complications was high among first time diabetic eye screening patients. Nonetheless, the knowledge was comparatively less. Hence, spreading knowledge of diabetes and its related complications through TV, news papers, health education posters in the medicine clinic and eye clinic of all health centers and hospitals is extremely crucial as this will motivate diabetic patients to actively engage in health seeking behavior, such as go for eye check-up. Such awareness and knowledge could lead to better understanding and acceptance of the importance of routine eye examinations for the early detection and treatment of eye diseases, thereby reducing the incidence of this potentially blinding disease. Last but not least, the development of an integrated health and social care pathway, including further

education and better communication between all relevant parties, would help in reducing the prevalence of diabetic retinopathy.

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