Research Article

PREVALENCE AND SEVERITY OF DIABETIC RETINOPATHY WITH ASSOCIATED VISUAL IMPAIRMENT AMONG TYPE 2 DIABETICS IN PRIMARY HEALTH CARE BASED SCREENING PROGRAMME IN AL AHSA DISTRICT OF SAUDI ARABIA

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ABSTRACT

Background

Diabetic retinopathy is fast emerging as one of the most common cause of avoidable blindness throughout the world. Many studies conducted in various parts of Saudi Arabia have supported this trend. The Ministry Of Health has initiated a vigorous screening programme for the detection of DR among the PHC registered cases on a special form designed for it. This study determined the prevalence of diabetic retinopathy with special attention to the severity and Vision Threatening DR (VTDR). The result of this study will also help in accurately estimating the future burden of the blinding DR and effectiveness of the present screening programme.

Methods

A retrospective cross sectional descriptive study was done by reviewing the records of comprehensive ophthalmological examination done on the diabetic patients of Al Ahsa region under the DR screening programme. The records of ophthalmological examination were reviewed during the period of October to December 2016. The case record review extracted demographic, profile of diabetes, vision and fundus examination results.

Results

The overall prevalence rate of DR was 28.65 (95% CI 28.59-28.76) (N= 100). Eighty eight percent (N=88) of them were having diabetic retinopathy in both eyes. The prevalence of Diabetic retinopathy was significantly more in the left than the right eye (28.7 V 27.2, p=.000). The prevalence was significantly more in male than female (34.44% vs 24.24 %, p=.032). Seventy three percent (N=73), three percent (N=3), five percent (N=5) and one percent (N=1) were suffering from Mild NPDR, Moderate NPDR, Severe NPDR and PDR and end stage Diabetic retinopathy respectively. Thirty two (N=32) were suffering from CSME with various stages of DR. Thirty one percent (N=18) of patients with Mild NPDR, Sixty seven percent of Moderate NPDR (N=2 out of 3), hundred percent of PDR (N=3), twenty one percent of Mild NPDR with CSME (N=3), thirty three of Moderate NPDR (N=5) with CSME, and twenty percent (N=1) of Severe NPDR with CSME were suffering from visual acuity between 6/9-6/18 respectively. Five percent of Mild NPDR (N=3), twelve percent of Mild NPDR with CSME (N=12), sixty seven percent of Moderate NPDR with CSME (N=10), and eighty percent of Severe NPDR with CSME (N=4) were suffering from low vision respectively. One patient with end stage disease was totally blind.

Conclusions

As compared to previous screening, the prevalence of DR in Alhasa diabetic patient is found to be comparatively low. However it might be the reason of the inclusion of 56 % of diabetic patients with shorter duration of diabetes. A good number of diabetic retinopathy especially DR patients with CSME were suffering from low vision which might have been improved by laser treatment.

INTRODUCTION

Diabetes Mellitus (DM) is a huge community health problem throughout the world. The prevalence of DM is increasing day by day. According to one estimate the prevalence of DM for all age-groups worldwide was estimated to be 2.8% in 2000 which is expected to rise to 4.4% in 2030. In other words the total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030[1]. DM is responsible for a number of serious health problems. The

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morbidity and mortality caused by chronic complications of DM is posing a real threat to the health of the society. DM is responsible for both micro vascular (Diabetic retinopathy, Nephropathy and Neuropathy) and macro vascular (Cardio vascular disease, Peripheral Vascular disease) complications. With the increase in the number of DM, these complications are bound to rise enormously. Prevention of these complications is a huge public health challenge for almost every country of the world. Diabetic Retinopathy (DR), a micro vascular complication of diabetes is proving to be one of the major contributing factors towards the morbidity of DM. Although the DM increases the risk of a range of eye diseases but the main cause of blindness associated with diabetes is Diabetic Retinopathy (DR)**.**

Diabetic Retinopathy (DR) is a microangiopathy affecting retinal precapillary arterioles, capillaries and venules due to DM. Hyperglycemia is responsible for enzymatic glycation, Intracellular sorbitol accumulation, free radicals formation, glycated end product production and Protein kinase C activation which causes retinal microvascular endotheliopathy resulting in increased permeability, capillary occlusion and neovascularization. This results in different types of DR. Prevalence of DR has fast emerged as one of the most common cause of preventable blindness in the recent years. According to the latest estimate by CDC, one third of adults over the age of 40years (4.2 million) with type 2 DM were suffering from DR in the USA and among them 655,000 had vision-threatening DR [2]. According to a recent meta-analysis, the overall global prevalence of DR has been found to be 34.6% (95% CI 34.5-34.8) with 10.2% of them suffering from Vision Threatening Diabetic Retinopathy (VTDR) (Joanne W Y, 2012). According to another estimate there were 126.6 million people with DR in the year 2010 globally which is expected to rise to 191.0 million by 2030. Likewise the number of VTDR is also expected to increase from the present 37.3 million to 56.3 million by the year 2030[3].

DR is also a major public health problem in Saudi Arabia. New data emerging from various studies demonstrate that blindness due to DR is increasing in Saudi Arabia and so Ministry of Health has reactivated its Prevention of Blindness (PB) unit and moved operational responsibility to areas responsible for Public Health and non-communicable disease (NCDs) (**New** IAPB Report, 2013). Review of literatures published within the past five years consistently found higher DR prevalence in different parts of Saudi Arabia which ranged between 27.8% to 36.4% [4]. There are two major stages of DR: an early stage non-proliferative diabetic retinopathy and a later stage proliferative diabetic retinopathy. DR is largely asymptomatic and vision is not affected in any stage until or unless central macular region of the retina is affected .Vision is affected if the macular area is affected either by leakage causing Clinically Significant Macular Edema (CSME) or by haemorrage or exudates. Routine screening for the detection of DR remains a very important part of management as it detects early treatable stages allowing for prompt treatment and prevention of visual loss [5].

The present study was conducted in Al Ahsa region of Saudi Arabia. Bordered with Qatar, UAE and Oman, Al Ahsa is the largest district of the eastern province of Saudi Arabia. A home to almost one million people, ssAl Ahsa consists of four major health sectors named Al-Hofuf, Al-Mobarraz, Al-Oyoun, and Al-Omran. According to the latest statistics there are around 25 thousand Primary Health care Center (PHC) registered type 2 DM cases in the whole Al Ahsa region. In a study concluded way back in the year 2010 the researchers have found a prevalence rate of DR to be 30 % in this region[6]. The Ministry Of Health has initiated a vigorous screening programme for the detection of DR among the PHC registered cases on a special form designed for it. This study has re determined the prevalence of diabetic retinopathy with special attention to the severity and VTDR. The result of this study is going to help in accurately estimating the future burden of the blinding DR and effectiveness of the present screening programme.

MATERIALS AND METHODS

This cross sectional descriptive study was conducted during the period of October-December 2016 .The study population consisted of all the adult type 2 DM patients in Al Ahsa district of Saudi Arabia registered at the Primary Health Care Centers and have undergone routine eye examination for the detection of DR. It consisted of around 25000 cases who were attending 4 Ministry of Health managed health sectors area of Al ahsa district. To calculate representative sample, we used Epi Info (version 6; November, 1993). With the assumption that the prevalence of DR may be between 31% and 36% and to **achieve the confidence level of 95%,** we **needed** 349 persons with diabetes. Stratification of the sample to the 3 health sectors of Al Ahsawas done based on the population proportion to the size (PPS).Chronic clinics were randomly selected in each health sectors of Al Ahsa and every second type 2 DM patients attending the clinic was selected for the data record after taking their consent. Inclusion criteria was all the type 2 diabetics screened at the Primary Health care while the exclusion criteria was Type 1 diabetics and those diabetic who were having media opacities such as cataract or corneal opacity. Data were collected on age, gender, geographical distribution, the status of diabetes (duration, control), previous screening year, result of previous screening, associated disease condition, recent Hb1AC result and the results of the ophthalmic examination (visual acuity, external eye exam and fundus examination results). The Trafford Laboratory reference was considered in defining the control of diabetes with HbA1c less than 6.5% as excellent controlled, HbA1c 6.6% - 7.5% as good control,HbA1c 7.6% - 8.9% as moderate control and HbA1c greater than 9.0% as poor control. The ethical approval for this study was sought from Ministry of health Saudi Arabia.

Ophthalmic examination and subgroups

The Type 2 DM patients were referred by the general physicians to the ophthalmologists for routine ophthalmic examination on the prescribed form especially designed for this purpose. The subjects were subjected to complete ophthalmological examination including vision tests and dilated fundus examination. The vision test was done by snellen chart keeping at 6 meter distance with best correction. The World Health Organization uses the following classifications of visual impairment. 20/30 to 20/60 is considered mild vision loss, or near-normal vision

20/70 to 20/160 is considered moderate visual impairment, or moderate low vision .6/60 to

- 20/500 to 20/1,000 is considered profound visual impairment, or profound low vision

- less than 20/1,000 is considered near-total visual impairment, or near total blindness
- no light perception is considered total visual impairment, or total blindness.

The visual acuity was defined as the vision in the better eye with best correction as defined by WHO. Normal vision was defined as visual activity of 6/6.A vision between 6/9 to 6/18 was considered mild vision loss, or near-normal vision. A vision worse than6/18 to 6/36 was considered moderate visual impairment, or moderate low vision. A vision worse than 6/36 to 1/60 was considered severe visual impairment or severe low vision. A vision less than 1.60 to count finger was considered as near total blindness. No light perception was considered total visual impairment, or total blindness. The fundus examination findings were based on the indirect ophthalmoscopy and the retinal examination with a +90 Diopter Volk lens and Topcon Slit lamp. All data were collected from the Primary Healthcare Centre (PHC)'s diabetic retinopathy screening records and patients' chronic disease files and transferred to data collection sheets.

Subjects were divided into five groups based on age (from the patient chart): Group 1 (40 years or less); Group 2 (41–50 years); Group 3 (51–60 years); Group 4 (61–70 years), and Group 5 (greater than 70 years). Duration of diabetes was calculated from the date of the original diagnosis to the date of data evaluation for this study. Duration was rounded to the nearest year and classified as 1- 5 years; 6–10 years; 11–20 years, and greater than 20 years. The recent reading of Hb1Ac was recorded for every subject. Diabetic retinopathy was graded according to the International Clinical Diabetic Retinopathy Severity Scale. The findings were grouped as Normal, Mild NPDR, Moderate NPDR, Severe NPDR, PDR and End stage DR. Vision Threatening Diabetic retinopathy (VTDR) was defined as proliferative DR and/or diabetic macular edema.

Data analysis

Statistical analyses were carried out using the Statistical Package for Social Sciences version (SPSS) 21. Chi-square statistics were used to assess associations between variables. Data were calculated with their respective 95% CI. The data were presented as mean ± SD. A P value less than 0.05 was considered statistically significant.

RESULTS

The records of 349selected type 2 diabetic patients who were screened on special forms for the detection of diabetic retinopathy were taken out from their files. Of these 349records, 151 (43.3%) belonged to male with a mean age of 55.80±11.23 (range 19-87 years). More than fifty percent (57.6%) belonged to rural area and the mean duration of diabetes was 9.93±6.91 (range 1-30 years). The mean Hb1Ac was 8.05 % with std deviation of ±1.85 (Range 4.8-22%).Only 18.3% of the diabetic patients were excellently controlled while 28.6 % were good control 27.8% were moderate control and 25.4% were poorly controlled. More than fifty percent (56.1%) of the patients were screened for the first time while 42.9% and 1% were following up between 1-5 years and more than 5 years respectively. Eighty nine percent of the subjects were on oral hypoglycaemic treatment while almost 6% and 5% were on insulin and combination of insulin and oral hypoglycemic treatment. The details of the demographic information are given in Table 1.

Table 1 Demographic characteristics of the study subjects

Variables	NO.	Percentage
Gender		
Male	151	43.3
Female	198	56.7
Age	Mean 55.8+-11.23	Range 19-87 years
Duration of diabetes	Mean 9.93	Range 1-30
Geographic distribution	201	57.6
Rural urban	148	42.4
Hb1AC Diabetic controlled status	Mean 8.05 +-1.85	Range 4.8-22%
Excellently controlled Good	64	18.3
controlled Moderate controlled	100	28.6
Poorly controlled	96	27.8
	89	25.4
Screening status		
First time screened Screened	196	56.1
between 1-5 years Screened more	150	42.9
than 5 years	3	1
Treatment Status On oral		
hypoglycaemic treatment	311	89
On insulin treatment On both insulin	21	6
and oral hypoglycaemic treatment	17	5

Prevalence of DR

The overall prevalence of DR and VTDR were 28.65 (95% CI 28.59-28.76) (N= 100) and 4.4% (95% CI, 3.5%–5.7%) respectively. Eighty eight percent (N=88) of them were having DR in both the eyes. The prevalence of DR was significantly more in the left than the right eye (28.7 vs. 27.2, p=.000). The prevalence was significantly more in male than female (34.44% vs.24.24%, p=.032). The prevalence of DR was more in urban area than rural area (35.81 vs. 23.38, p=0.340) but it was not statistically significant. In multiple logistic regression, independent risk factors for any retinopathy were longer diabetes duration [OR=1.94 95%CI 1.93-1.96] per year increase), higher hemoglobin A1c [OR=1.89, 95%CI 1.88-1.91] per % increase), and older age [OR= 2.30, 95%CI 2.29-2.32] per decade increase (table 2).

Table 2 Prevalence of Diabetic Retinopathy

Characteristics	Study population	DR present	Frequency
Gender			34.44
Male	151	52	24.24
Female	198	48	28.65% (95% CI
Total	349	100	28.59-28.76)
Eye			27.16
Right eye		88	28.65
Left eye		100	27.16
Both eyes		88	
Geographic distribution			23.38
Rural	201	47	35.81
Urban	148	53	P=0.340
Age			35.48
<40 years	31	11	18.18
41-50 years	77	14	29.85
51-60 years	134	40	27.03
61-70 years	74	20	30.30
>70 years	33	10	P=.003
			OR= 2.30, 95%CI 2.29-2.32
Duration of diabetes			18.42
0-5 years			22.22
6-10 years	114	21	34.33
11-15 years	101	22	45.45
16-20 years	67	23	39.13
>20 years	44	20	P=.003
	23	9	(OR=1.94 95%CI 1.93-1.96)
Control of diabetes			14.28
Excellently controlled			19.59
Good Controlled	63	9	29
Moderate controlled	97	19	48.86
Poorly Controlled	100	29	P=.030
	88	43	OR=1.89, 95%CI 1.88-1.91

As far as the grade of diabetic retinopathy is concerned fifty nine percent (N=59), fourteen percent (N=14), three percent(N=3),fifteen percent(N=15), five percent (N=5) ,three percent(N=3) and one percent (N=1) were suffering from Mild NPDR, Mild NPDR with CSME, Moderate NPDR, Moderate NPDR with CSME, Severe NPDR with CSME , PDR and end stage Diabetic retinopathy respectively.

Table 3 Prevalence of different stages of DR among the detected cases of DR

Stages of DR	Total number of subjects N=349	Total number of Male N= 151	Total number of female N=198
Mild NPDR	59 (16.90%)	29 (19.2 %)	30 (15.15%)
Mild NPDR with CSME	14 (4.01%)	8 (5.31%)	6 (3.03%)
Moderate NPDR	3 (0.9%)	2 (1.33%)	1 (0.50%)
Moderate NPDR with CSME	15 (4.30%)	7 (4.63%)	8 (4.04%)
Severe NPDR with CSME	5 (1.44%)	1 (0.66%)	2 (1.02)
PDR	3 (0.86%)	4 (2.65%)	1(0.50%)
End stage DR	1(0.29%)	1 (0.66%)	0
Total	100(28.70)	52 (34.44%)	48(24.24%)

More than eighty two percent (N=289) of the patient had vision of 6/6 while 8.6% (N=30) of the patient were having vision between 6/9 – 6/18 .More than eight percent of the patients (N=29) were suffering from moderate to severe visual impairment (between 6/24- 6/60) and one subject was completely blind due to advanced stage of diabetic retinopathy. Among the patients suffering from Mild NPDR and Moderate NPDR, sixty four percent (N=38, out of 59) and thirty three percent (N=1 out of 3) were having 6/6 vision respectively. Thirty one percent (N=18) of patients with Mild NPDR, Sixty seven percent of Moderate NPDR (N=2 out of 3), hundred percent of PDR (N=3), twenty one percent of Mild NPDR with CSME (N=3), thirty three of Moderate NPDR (N=5) with CSME, and twenty percent (N=1) of Severe NPDR with CSME were suffering from visual acuity between 6/9-6/18 respectively. Five percent of Mild NPDR (N=3), twelve percent of Mild NPDR with CSME (N=12), sixty seven percent of Moderate NPDR with CSME (N=10), and eighty percent of Severe NPDR with CSME (N=4) were suffering from low vision respectively. One patient with end stage disease was totally blind.

Table 4 Showing vision status with Diabetic retinopathy

Visual status of the subjects	DR percent/Number	No DR patients
6/6	39	250
6/9-6/18	30	0
6/24-6/60	30	0
No perception of light	1	0
Total	100	249

Madinah Al munawrrah(36.1%)[8] and Riyadh district (52%) [9] Of Saudi Arabia, Yemen (55%)[10], Pakistan(42.86%)[11], Iran (37%) [12] and Jordan (34.1%)[13] and higher than that found in Qatar (23.5)[14], Egypt (20.5)[15], UAE (19%)[16], India (18%)[17] and Spain (12.3%)[18]. Almost similar result was found in one American study where estimated prevalence of DR was detected to be 28.5% [19] (95% CI, 24.9%–32.5%) and Vision threatening diabetic retinopathy was 4.4% (95% CI, 3.5%–5.7%)[19]. The same type of study done one decade back in the same population of Saudi Arabia has found 30% prevalence of DR [6]. In the present study the VTDR among the detected DR cases was 37% (95% CI 36.92-37.14) which is significantly lower than what is found in a hospital based study in Saudi Arabia (40%),[20]Yemen 39%[10], while significantly higher than Iran 14.0% (95% CI: 11.3–16.7)[12] and Singapore 9.0% (95% CI, 5.8–13.8)[21]] Oman 10% % (1,600–4,700 cases[22]),USA 9.3%(95% CI, 5.9%–14.4%)[19] and India 3.8% (95% CI 2.70 to 4.86%)[17]. The prevalence of DR was significantly more in male than female (34.44% vs. 24.24 %, p=.032) which is true with same type of study in other place of Saudi Arabia (39.24% vs. 31.86%, P=-002)[9]. However the prevalence of DR was statistically higher among the females in the study of Egypt (22 vs. 17%, p<.05)[15] and Oman (32 vs. 28%, p=0.04)[22].

Thirty percent of patients detected with DR in our study had a vision of 6/18 or better (6/9) in the eye with worse vision and the same number of patients with DR had vision between 6/24 -6/60 .In a similar study in India 22.18%[17] of patients detected with DR had a vision of 6/18 or better in the eye with worse vision .However in Qatar[14] study Visual acuity in the better eye was 6/6 to 6/18 in 90% of persons with DR. In our study more than fifty percent of the patients suffered from mild NPDR followed by Moderate NPDR, Severe NPDR and PDR which consisted of 3%, 5% and 1% respectively. However a quite high number of diabetics with different stages (32%) of DR were suffering from CSME. In a similar study in **Vanuatu**[23], the researchers have found a lower prevalence of mild NPDR (20.6%) but a higher prevalence of Moderate NPDR (17.6%) and an equal prevalence of PDR .In this study only 4.5% of the patient with DR had CSME with different stages of DR. In a large sample Spanish study, a high prevalence of Moderate NPDR (27%), Severe NPDR (7%) and PDR (4%) has been found. However in this study only 4.5% of the cases were suffering from macular edema.

Table 5 Showing visual status with different stages of DR

Visual status	Mild npdr	Mild npdr with csme	Moderate npdr	Moderate npdr with csme	Severe npdr	Severe npdr with csme	Pdr	End stage disease	Total
Normal 6/6	38	0	1	0	0	0	0	0	39
6/9-6/18	18	3	0	5	0	1	3	0	30
6/24-6/60	3	11	2	10	0	4	0	0	30
<6/60	0	0	0	0	0	0	0	0	0
No perception of light	0	0	0	0	0	0	0	1	1
Total	59	14	3	15	0	5	3	1	100

DISCUSSION

The overall prevalence of DR in our study was 28.65% which is significantly lower than that found recently in the same type of study conducted in Abha (36.4%)[7],

CONCLUSION

A high prevalence of DR with considerable amount of visual loss among them and significantly higher number of advanced stage of DR with CSME is a matter of concern among the type 2 diabetic population of Al Ahsa. The incidence of diabetic

retinopathy is expected to rise substantially in the coming years due to increasing number of diabetic cases. According to one estimate, only 35% of the diabetic patients have been screened for the detection of DR in Al Ahsa region. There is a need of a fast and effective screening system in place to detect the diabetic retinopathy in their early stages for proper and effective treatment to prevent the avoidable blindness occurring due to diabetic retinopathy. hd Farouk Ah

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