



Prevalence of Diabetic Retinopathy Among Diabetic Hypertensive and Non-Hypertensive Patients in Riyadh, Saudi Arabia

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Abstract

Introduction: Diabetic Retinopathy (DR) is the leading disease to blindness in Saudi Arabia and around the world which causes irreversible blindness and visual impairment among the adults as well as the elderly people. Diabetes mellitus, older age, and hypertension are the risk factors for DR.

Aim of the study: This study is retrospective and was conducted at Security Forces Hospital (SFH), Riyadh, SA. Which aimed to determine the prevalence of diabetic retinopathy among hypertensive and non-hypertensive patients.

Results: The study included 1600 confirmed diabetic legible patients out of them 205 participants had Diabetic retinopathy (DR). The overall prevalence of DR in all of patients' was 12.8%, while the prevalence of DR in type 2 DM was 12.7%, it was 13% in type 1 DM. The overall prevalence of NPDR was 12.1% and PDR was 0.68%. The prevalence of NPDR more frequent than PDR among DR patients were it was 94.6% and 5.4% respectively. The study shows that there is a significant correlation between hypertension and diabetic retinopathy with patients who have diabetes mellitus type 2.

Conclusions: This study concludes that, there is a significant rise in the prevalence of DR in patients who have DM type 2 in the hypertensive group. More studies are required in the future with a large number of samples and in different places to prove the correlations between hypertension and diabetic retinopathy.

Keywords: Diabetic Retinopathy (DR); Non Proliferative Diabetic Retinopathy (NPDR); Proliferative Diabetic Retinopathy (PDR); Prevalence; Diabetic Macular Edema (DME)

Introduction

In working aged population, Diabetic retinopathy seems to be the major cause of vision loss that can be prevented, and it is caused by diabetes mellitus complication [1]. In 2020, it was estimated that diabetic retinopathy prevalence, is around 103.12 million globally and one in five patients who diagnosed with diabetes mellitus [2]. Different studies have investigated risk factors of diabetic retinopathy in different places. It has been proved that hypertension is one of major causes of diabetic retinopathy [3,4].

In recent decades, the number of patients with DR seen increased rapidly in Saudi Arabia. In Saudi Arabia, despite advancements in diabetic retinopathy treatment, well established screening services, and the availability of free health coverage, there are still considerable number of patients presenting late with advanced diabetic retinopathy.

In addition, the prevalence of DR in Saudi Arabia was found in one study to be 19.7%, with 53% of them reported to have proliferative diabetic retinopathy (PDR) [5]. Barriers in access to diabet-

ic retinopathy screening could delay diagnosis and management, leading to progression of the disease and consequently poorer prognosis.

Subjects and Methods

This is a hospital based and retrospective study retrieved from the patients records having diabetic mellitus, hypertensive and non-hypertensive patients. This study is performed in Security Forces Hospital (SFH), Riyadh, Saudi Arabia. This data is extracted from medical electronic records of the patients after systematically applying the inclusion and exclusion criteria. The primary objective of this study was to determine the prevalence of DR among hypertensive and non-hypertensive patients. In addition, the secondary objectives were to estimate the proportion of patients who developed proliferative & non-proliferative DR in hypertensive & non-hypertensive groups and to evaluate the status of the macula in in all of groups.

Data has been collected for one year duration starting from January 2022 to December 2022. Ethical approval has been obtained from the research committee at security force hospital (approval number 23-682-46) as well as the study adhered to the tents of Declaration of Helsinki.

Setting and data source

Data were taken from Security Forces Hospital database patient's records who have visited the hospital during aforementioned period into Diabetic Care Center. To estimate the diabetic retinopathy prevalence, retina photos have been reviewed that were recorded in medical files.

Inclusion criteria

Male and female patients above the age of 18 years, patients diagnosed with diabetes mellitus, Saudi and Non- Saudi patients.

Exclusion criteria

Age below 18 years, traumatic eye injuries, cases of ocular diseases such as cataract, uveitis, corneal opacity, glaucoma, past medical history of coagulopathy diseases, patient with ocular diseases that hinders fundus photography.

Participants and sample size

The study included 205 out of 1600 patients all with Diabetes Mellitus and detailed analysis of patient reports based on fundus photos of diabetic retinopathy in hypertensive and non-hyperten-

sive patients who visited Diabetic Care Center at Security Forces Hospital. The study also checked patients data whether they were diagnosed with Proliferative diabetic retinopathy or non – proliferative diabetic retinopathy. The other possibilities were if the patient has macular edema or no macular edema. The study included both type 1 and type 2 Diabetic Mellitus whom have coexisting hypertension (n = 96) and whom were normotensive (n = 109). Patients' details have been extracted through information technology department according to inclusion and exclusion criteria and each patient was checked whether he was hypertensive or non-hypertensive. Secondly, the patients were separated on the basis of type of Diabetic Mellitus. Then, they were categorized under proliferative diabetic retinopathy or non-proliferative diabetic retinopathy and if there is macular edema or no macular edema.

Data management and analysis plan

Categorical data summarized as absolute numbers and percentages. Continuous data shortened as mean and standard deviation (SD). Proportions in groups compared by using chi-square test. Comparison between groups for continuous variables performed using student's T test. Multiple logistic regression models were used to estimate the adjusted relative risk, adjusting for other predictors. The Kaplan–Meier estimator also used to compare the incidence between groups. All analyses are performed by using SPSS calculations.

Results

As the study aims to investigate the prevalence of Diabetic retinopathy among hypertensive and non-hypertensive patients. Different statistics have been used in order to achieve these objectives. Data were collected for 1600 confirmed diabetic legible patients out of them 205 participants had Diabetic retinopathy (DR) including 50.7% females and 49.3% males. Hypertensive group accounts for 46.8% while the non-hypertensive group includes 53.2%. The participant gender p-value in this study shows no significant difference between the hypertensive and non-hypertensive groups. On the other hand, the p-value indicates a significant difference for participants' age in hypertensive and non-hypertensive groups. Participants overall mean age was 55.09 ± 14.56 years. In hypertensive group the mean age was found to be 62.71 ± 10.63 years old while the mean age was 48.38 ± 14.28 years old in non-hypertensive group. It's clear that lower age average was seen higher in non-hypertensive group in comparison with hypertensive group.

The overall prevalence of DR in all of patients' was 12.8% (205 out of 1600 patients). While the prevalence of DR in type 2 DM was 12.7% (179 out of 1400 patients), it was 13% in type 1 DM (26 out of 200 patients). The overall prevalence of NPDR (Figure 3) was 12.1% (194 out of 1600 patients) and PDR (Figure 5,6) was 0.68% (11 out of 1600 patients), while the prevalence of NPDR more frequent than PDR among DR patients where it was 94.6% and 5.4% respectively.

As shown in Table (1) data emphasize that 12.7% of DR participants was type 1 DM and 87.3% was type 2 DM. Based on that, there was a significant difference between hypertensive and non-hypertensive participants in DM type 1 group and in DM type 2 group (P-value <0.001). Furthermore, participants with DM type 1 appeared to have a lower percentage in hypertensive group in comparison with non-hypertensive group (7.2% versus 92.3%), while participants with DM type 2 were observed higher in hypertensive group (52.5% versus 47.5%).

Mean ± SD or n (%)		All (N = 205)	Non Hypertensive (n = 109)	Hypertensive (n = 96)	P value
Sex	Male	101 (49.3)	56 (55.4)	45 (44.6)	0.520
	Female	104 (50.7)	53 (51.0)	51 (49.0)	
Age		55.1 (4.6)	48.4 (± 14.3)	62.7 (± 10.6)	<.001
Type 1 DM	Yes	26 (12.7)	24 (92.3)	2 (7.2)	<.001
	No	179 (87.3)	85 (47.5)	94 (52.5)	
Type 2 DM	Yes	179 (87.3)	85 (47.5)	94 (52.5)	<.001
	No	26 (12.7)	24 (92.3)	2 (7.2)	
PDR	Yes	11 (5.4)	5 (45.5)	6 (54.5)	0.598
	No	194 (94.6)	104 (53.6)	90 (46.4)	
NPDR	Yes	194 (94.6)	104 (53.6)	90 (46.4)	0.598
	No	11 (5.4)	5 (45.5)	6 (54.5)	
Macular Edema	Yes	68 (33.2)	40 (55.8)	28 (41.2)	0.253
	No	137 (66.8)	69 (50.4)	68 (49.6)	
Non Macular Edema	Yes	137 (66.8)	69 (50.4)	68 (49.6)	0.253
	No	68 (33.2)	40 (55.8)	28 (41.2)	

Table 1: Demographics of hypertensive and non-hypertensive DR participants.

SD = Standard deviation

DM = Diabetic mellitus

DR = Diabetic Retinopathy.

Also, Table (1) demonstrates that there is almost equal sex distribution. Non hypertensive patient were a little bed more than hypertensive in both of sexes (55.4% versus 44.6% for males) and 51% versus 49% in females) with no significant difference (P = 0.52). The majority of DR patients were type 2 DM (87.3%) comparing to 12.7% type 1 DM (P value<.001). Subgroup analysis showed that proliferative Diabetic Retinopathy (PDR) in this study was found in 11 patients (5.4%) while participants who had non-proliferative Diabetic Retinopathy (NPDR) found in 194 patients account for (94.6%). Out of the 11 patients with PDR 5 patients (2.43%) was hypertensive, while 6 patients (2.92%) were non-hypertensive. This results illustrated that PDR distribution is not sig-

nificantly different among the hypertensive and non-hypertensive groups (P = 0.598). Correspondingly, participants' distribution who were Non-Proliferative Diabetic Retinopathy (NPDR) displayed non-significant correlation among hypertensive and non-hypertensive groups (p = 0.598).

In relation to Macular Edema, results indicate that 66.8% of participants had no Macular Edema and 33.2% had Macular Edema (Figure 4). In addition, macular edema displayed around 41.2% in hypertensive group while in non-hypertensive group macular edema showed 55.8%. On the other hand no macular edema variable shows mostly equal numbers of patients in both groups.

Thus, macular edema distribution displayed no significantly correlation in both hypertensive and non-hypertensive groups (p = 0.253). Correspondingly, patients without macular edema also

indicates no significant correlation between hypertensive and non-hypertensive groups.

Outcome		No of cases	Rate	OR (95% CI)	p-value
DM	Type 1	2	2.083	0.08 (0.01 - 0.34)	0
	Type 2	94	97.917	16.03 (3.71 - 69.22)	0
Diabetic retinopathy		96	100	0.95 (0.91 - 0.99)	0.038
Diabetic Retinopathy (DR)	Proliferative	6	6.25	1.45 (0.42 - 4.91)	0.546
	Non-proliferative	90	93.75	1.44 (0.5 - 4.12)	0.493
Macular Edema	Yes	28	28.125	0.72 (0.4 - 1.3)	0.281
	No	68	70.833	1.58 (0.88 - 2.82)	0.118

Table 2: Shows the odd ratio results for hypertension group.

As shown in Table (2), Based on Logistic Regression analysis, it's clear that there is an increase in odd ratio for the patients who had diabetes mellitus type 2 in hypertensive group (OR = 16.03 (3.71 - 69.22), p-value = 0.00). In contrast, the odd ratio for patients with DM type1 in hypertensive group shows to be low (OR = 0.08 (0.01 - 0.34) p-value = 0.00). In a similar way, diabetic retinopathy odd ratio for patients in hypertensive group was observed low (OR = 0.95 (0.91 - 0.99), p-value = 0.038). Finally, PDR, NPDR, macular edema and non-macular edema comparisons indicate insignificant impact.

Figures 1-6, representing normal, NPDR, Macular Edema and PDR cases from the study.



Figure 1: OD, Normal Fundus.



Figure 2: OS, Normal Fundus



Figure 3: OS, NPDR.

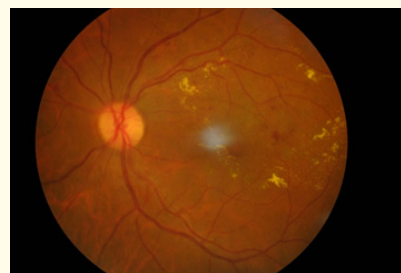


Figure 4: OS, NPDR with Macular Edema.



Figure 5: OD, PDR.

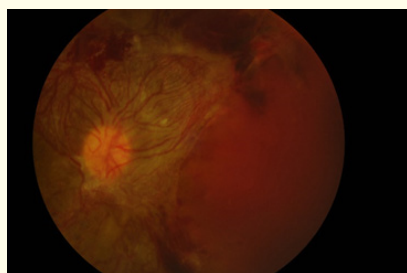


Figure 6: OS, PDR, with vitreous HE.

Discussion

The worldwide prevalence of Diabetic Retinopathy was recently estimated to be 34.6%. In Ethiopia, the prevalence of diabetic retinopathy at study conducted in Jima, Arbaminch and Debre-markos hospitals was 41.4%, 13%, and 18.5% respectively [6-8]. Yang, *et al.* (2019) concluded that the prevalence of DR in T2 DM patients from Singaporean, Indian, South Korean, Malaysian, Asian, and Chinese was 33%, 42%, 16%, 35%, 21% and 25%, respectively [9].

In our study the DR prevalence was lower than those studies and this difference may be attributed to many reasons as the study is not representing all Saudi population but specific for certain group of patients belong to Security Forces Hospital (SFH) with high level of health care, lower age range, shorter duration of DM onset, difference in socioeconomic status, education level, Body mass index (BMI) and life style of our patient. As well as advancements in diabetic retinopathy well established screening services, and the availability of free health coverage.

This study proves that there is a significant rise in the prevalence of DR among patients who have DM type 2 in hypertensive group. On the other hand, macular edema and PDR show no significant correlation with hypertensive and diabetes mellitus groups and these results correspond with a study by Zhang, *et al.* (2023),

which outlines an increase of DR in hypertensive patients with an OR of 1.08. In contrast, Zhang, *et al.* reported that OR was increased also for PDR and macular edema in hypertensive group [10].

Correspondingly, in 2020, Tilahun, *et al.* performed a study over 302 patients at a hospital in Ethiopia and found there an increase in OR for hypertensive group [11]. Moreover, Naserrudin, *et al.* (2022) reported that hypertension is a major risk for DR patients (OR = 1.63) [12]. On the other hand, this study comes in contrast with a study by Ejigu and Tsegaw, (2021) which outlined a significant raise of macular edema and PDR among hypertensive patients [13]. Meanwhile, Ejigu and Tsegaw, (2021) emphasized that diabetic retinopathy prevalence is correlated significantly with hypertension and diabetes mellitus type 2 [13]. Our results concludes that early screening and routine checkup are very important for patients who have diabetic mellitus type 2 and hypertension to detect DR in premature stages and prevent disease progression.

Limitations of our study that it is conducted on certain group of patients, not representing all Saudi community with relatively limited number of patients and it is not conducted in multicenter bases but it sounds the alarm about the importance of regular ophthalmological follow up and fundus examination with specific program to diabetic patients.

Conclusions

This study concluded that there is a significant rise in the prevalence of DR patients who have DM type 2 in the hypertensive group. In addition, this study don't show significant correlation for PDR, NPDR, macular edema and non-macular edema between hypertensive and non-hypertensive groups. Based on our results, NPDR is more common than PDR so that, we should pay more attention to NPDR screening and its management, and we also recommend suitable interventions to prevent its progression. As well as more studies are required in the future with a large number of samples and in different places to prove the correlations between hypertension and diabetic retinopathy. Ended It is important to develop a national annual retinal screening program and to develop trained personnel at all levels for providing high quality affordable diabetic eye care services for diabetics in Kingdom of Saudi Arabia.

Conflicts of Interests

The authors declare that they didn't have either conflict of interests or financial interests as well as these data have not been published before.

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