

Original Article

Pattern of Diabetic Retinopathy in a Referral Hospital in Resource Limited setting; Institution Based Cross-sectional Study

Feven Feleke*¹, Dereje Negussie¹,

¹Addis Ababa University

Corresponding authors*: fevenfeleke57@gmail.com

Abstract

Background: Diabetes mellitus comprises a group of metabolic disorders that share the common feature of hyperglycemia. One-third of the global population of individuals with diabetes is estimated to have diabetic retinopathy.

Method: The institution based cross sectional study was conducted at Menilik II Hospital from March 2022 to September 2022 GC. A complete eye exam was performed to reach a diagnosis by a retina specialist using a slit lamp microscope coupled with a 90D lens. Data were entered and analyzed using the Statistical Package for Social Science.

Results: In this study, a total of 222 diabetic patients were enrolled. There were 116 males (52.3%). Diabetic retinopathy was mild in 28 (12.6%), moderate in 58 (26.1%), severe in 23 (10.4%) and proliferative in 60 (27%) patients. Moderate and severe visual impairment was observed in 26 (15.1%) patients; 24 (14.2%) had mild visual impairment, and 53 (31.4%) patients were blind. Among the 163 diabetic retinopathy patients who had fasting blood sugar tests, 109 (66.9%) had poor glycemic control. Among the 56 diabetic retinopathy patients who had Hb A1c measurements, 89.5% had poor glycemic control.

Conclusion: Visual-threatening diabetic retinopathy is more common in patients with poorly controlled diabetes and requires multi-sectoral collaboration to decrease visual loss

Keywords: Diabetic retinopathy, Diabetic macular edema

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Introduction

Diabetes mellitus comprises a group of metabolic disorders that share the common feature of hyperglycemia. Diabetes is currently classified as type 1 DM or type 2 DM based on the pathogenic process that leads to hyperglycemia (1).

Diabetes is found in every population in the world and in all regions, including rural parts of low- and middle-income countries. The number of people with diabetes is steadily increasing, with the World Health Organization estimating that there were 422 million adults with diabetes worldwide in 2014 (29). In addition, the International Diabetes Federation estimates that 1.1 million children and adolescents aged 14–19 years have type 1 diabetes. Without interventions to halt the increase in diabetes incidence, there will be at least 629 million people living with diabetes by 2045 (2). Ethiopia is one of the five countries with the greatest number of people affected by diabetes in sub-Saharan Africa (3). Diabetic retinopathy is a leading

cause of vision loss worldwide among patients aged 25–74 years, especially in developed countries such as the United States. From 1990–2010, diabetic retinopathy was the fifth most common cause of preventable blindness and moderate to severe visual impairment (4). One-third of the global population of individuals with diabetes are estimated to have diabetic retinopathy; of that group, one-third are likely to have vision-threatening diabetic retinopathy.

The best predictor of diabetic retinopathy is the duration of the disease; thus, with increasing life expectancy, diabetic retinopathy and subsequent blindness tend to increase. (5,6)

The identification and optimum control of coexisting health and medical problems are critically important because they present a significant risk for the development and progression of diabetic retinopathy. These factors include chronic hyperglycemia, (7,8,9) hypertension, (11,12) renal disease, (1,10) abdominal obesity, hypercholesterolemia, dyslipidemia, cardiovascular

and peripheral autonomic neuropathies. A better understanding of the pattern of diabetic retinopathy can contribute to evidence-based and improved care for patients with diabetic retinopathy.

Methods and Patients

The study was conducted at Menilik II Comprehensive Specialized Referral Hospital from March 2022 to September 2022. The ophthalmology department has general outpatient clinics and five specialty clinics. Each day, 60 to 100 referred new patients seek service in addition to the patients being followed up in various clinics. The retina clinic, a specialty clinic, provides care for approximately 50 patients per day. An institution-based cross-sectional study was used to study the pattern and characteristics of diabetic retinopathy in diabetic patients evaluated at the retinal clinic. All patients above the age of 18 were included except those with opaque ocular media that did not allow adequate visualization of the fundus and retinopathy other than diabetic retinopathy. A total of 222 diabetic patients who received care and follow-up at the retina clinic during the study period and fulfilled the eligibility criteria were included in the study. Informed written consent was obtained.

A structured questionnaire was used to collect the demographic, clinical, and medical history and other characteristics of the study participants. Blood pressure was measured by a manual sphygmomanometer. If the blood pressure was elevated, two blood pressure measurements were taken at five-minute intervals, and the average of the measurements was calculated. Body mass index (BMI) was calculated using the formula (weight in kilograms/height in meters squared) after the weight in kg and height in meters were measured. The vision was determined using Snellen's chart at 6 meters by a trained nurse's right eye followed by the left eye by occluding one eye at a time. The best visual acuity was determined by an optometrist. Visual impairment was classified according to the WHO visual impairment classification. Intraocular pressure was measured using an air puff tonometer before the pupils were dilated. A slit lamp examination was performed to examine the anterior segment of the eye. The pupils were dilated using tropicamide 1%, and the posterior segment was examined using a 90-diopter lens coupled with a slit lamp biomicroscope. Retinopathy was diagnosed and graded by a vitreoretinal surgeon using the ICDRDSS (27). For patients with bilateral DR, data from the most severe eye were selected for analysis. A pertinent laboratory investigation was sent, and the findings were explained to the patient and managed accordingly. In this study, Diabetes mellitus was defined disorder of carbohydrate metabolism characterized by impaired ability of the body to maintain blood glucose level there by as a Fasting blood glucose concentration >126 mg/dl or Random blood sugar > 200 mg/dl, hemoglobin A1c 6.5% or higher or patients taking medication for diabetes. Non Pro-

liferative Diabetic Retinopathy (NPDR) is defined as when there is no new vessels or no extraretinal fibrovascular tissue, while Proliferative Diabetic Retinopathy (PDR) defined when there is new vessels in either iris, optic disc or retina.

Using International Clinical Diabetic Retinopathy Disease Severity Scale (ICDRDSS), No retinopathy; no abnormalities, Mild NPDR, microaneurysms only. Moderate NPDR- more than microaneurysms only but less than severe NPDR; Severe NPDR- any of the following: >20 intraretinal hemorrhages in each of four quadrants, definite venous beading in two or more quadrants, prominent IRMA in one or more quadrants and no PDR; and Very severe NPDR- any patient with two or more of the characteristics of severe NPDR. PDR - retinal neovascularization, vitreous hemorrhage, or preretinal hemorrhage.

As there was no OCT in Menilik II Hospital, ETDRS definitions of clinically significant macular edema (CSME) were used for retinal thickening at or within 500 μm of the center of the fovea, hard exudates at or within 500 microns of the center of the fovea with adjacent area of retinal thickening, and retinal thickening of at least 1 disc area, any portion of which was within 1500 μm (approximately 1 disc diameter) from the center of the fovea. Hypertension was defined as a blood pressure greater than or equal to 130/80 mm Hg, and hyperlipidemia was defined as a serum cholesterol concentration greater than 200 mg/dl.

The International Classification of Diseases II definitions of visual impairment were used: mild visual acuity worse than 6/12 to 6/18, moderate visual acuity worse than 6/18 to 6/60, severe visual acuity worse than 6/60 to 3/60, and blindness defined as visual acuity worse than 3/60. A smoker is someone who smokes any tobacco product, either daily or occasionally. Moderate activity is defined as at least 150-300 minutes of walking at a moderate or brisk pace, and vigorous activity is defined as at least 75-150 minutes of heavy exercise three times a week.

The data were entered into and analyzed using the Statistical Package for Social Science (SPSS) version 26. The frequency distribution, mean (\pm SD), range, and ratio were used to summarize data on independent variables. A bivariate logistic regression was performed for every explanatory variable, a p-value less than 0.25 was included in the multinomial logistic regression model, and a p-value less than 0.05 was considered to indicate statistical significance.

Ethical consideration

The research and publication committee of the Ophthalmology department of Addis Ababa University has approved this study to be conducted on 03/02/2022 with letter reference number OREC/002/22.

Results

In this study, a total of 222 diabetic patients were enrolled. There were 116 males (52.3%). The mean age was 56.1 years (SD = 12.116; range: 23-89 years). Oth-

Table 1. Sociodemographic characteristics of diabetic retinopathy patients . March 2022-September 2022 (n=222)

Socio-demographic characteristics	Category	Number	Frequency
Gender	Male	116	52.3%
	Female	106	47.7%
Age in years	20-30	8	3.6%
	30-40	23	10.4%
	40-50	47	21.2%
	50-60	76	34.2%
	>60	68	30.6%
	Place of residence	Urban	180
	Rural	42	18.9%
Marital status	Single	18	8.1%
	Married	141	63.5%
	Widowed	48	21.6%
	Divorced	15	6.8%
Education level	Can't read and write	18	8.1%
	Read and write	12	5.4%
	Primary school	65	29.3%
	Secondary school	47	21.2%
	Certificate/diploma/degree	80	36%
Occupation	Unemployed	57	25.7%
	Government worker	56	25.2%
	Private worker	58	26.1%
	Retired	51	23%
Average income	<1000	59	26.6%
	1000-2000	58	26.1%
	2000-3000	25	11.3%
	3000-6000	52	23.4%
	>6000	28	12.6%

The mean duration of diabetes since diagnosis was 14.5 years. The majority of the patients (92, 41.4%) had diabetes for at least 15 years. In terms of diabetes treatment, 102 patients (45.9%) were taking oral glucose-lowering agents. 92 patients (41.4%) were using insulin, 22 patients (9.9%) were taking oral glucose lowering medications along with insulin injections, and 6 patients (2.7%) were using only dietary management. Hypertension was present in 133 (59.9%), dyslipidemia in 75 (33.8%), neuropathy in 27 (12.2%), nephropathy in 6 (2.7%), heart disease in 12 (5.4%), and stroke in 2 (0.9%) of the patients. Additionally, 12 individuals had a history of smoking, 4 of whom were former smokers. Out of 222 patients, 89 (40.1%) patients had regular and recommended physical activity. Most of the patients (154, 69.4%) were not having eye compliant, and 60 (27%) of the patients had a history of visual reduction. Seventy-one (32%) patients had a history of other ocular illnesses (Table 2). Moderate and severe visual impairment was observed in 26 (15.1%) patients; and 53 (31.4%) patients were blind. DME was the underlying cause in 25 (19.3%) of the patients with visual impairment. (Table 3). Diabetes retinopathy was severe in 23 (10.4%) and proliferative in 60 (27%) patients. (Table-4). A total of 50 (22.5%) patients had a history of ocular surgery, the majority of whom had cataract surgery (41, 18.5%), followed by glaucoma (4, 1.8%), pars plana vitrectomy (2, 0.9%), scleral buckle (1, 0.5%), and pterygium excision (1, 0.5%).

Table 2 Ocular comorbidities in diabetic patients from March 2022-September 2022 (n=222)

Other ocular illness	Number	Frequency
Cataract	38	17.1%
Glaucoma	12	5.4%
AMD	5	2.3%
Uveitis	4	1.8%
Macular hole	3	1.4%
Retinal vein occlusion	3	1.4%
Corneal opacity	3	1.4%
Hypertensive retinopathy	1	0.5%
Endophthalmitis	1	0.5%
VKC	1	0.5%
Total	71	32%

Table 3: Visual impairment grading in diabetic retinopathy and DME patients in the worst eye from March 2022 to September 2022 (n=222)

Visual impairment in diabetic retinopathy patients	Diabetic retinopathy (Number)	Frequency	DME (Number)	Frequency
Mild visual impairment	24	14.2%	6	20.7%
Moderate visual impairment	26	15.4%	6	20.7%
Sever visual impairment	26	15.4%	5	17.2%
Blindness	53	31.4%	8	27.6%
Total	129	76.4%	25	86.2%

Intraocular injection and laser treatment were given to 41 (18.5%) and 22 (9.9%) patients respectively. PDR patients received the majority of the laser treatments (21 [9.5%]). Two Pars Plana Vitrectomy procedures were performed for PDR patients. Based on clinical examination, Diabetic Macular Edema was found in 29 (13.1%) of patients; only 5 patients underwent OCT examination, and 13 (44.8%) of the DME-diagnosed patients had a history of intraocular injection. High blood pressure was detected in 75 (44.4%) diabetic retinopathy patients. In addition, 98 (58%) of the patients had a normal BMI, and 14 (8.3%) were obese. Among the 163 diabetic retinopathy patients who had fasting blood sugar tests, 109 (66.9%) had poor glyce-

mic control; however, among the 56 diabetic retinopathy patients who had Hb A1c measurements, 89.5% had poor glycemic control. Total cholesterol, triglycerides, HDL, and creatinine were measured for some patients, and high values of each were found in 8 (17.8%) of the 45 patients, 9 (22%) of the 41 patients, 29 (65.9%) of the 44 patients, and 14 (29.8%) of the 47 patients, respectively. Most laboratory investigations and Optical Coherence Tomography were not performed in the hospital, as a result 60.8% of patients did not receive an investigation, and 37.4% of those patients could not afford the tests.

Table 4: Diabetic retinopathy grading in the worst eye between March 2022 and September 2022 (n=222)

Diabetic retinopathy	Male	Female	Total
Mild NPDR	13(5.9%)	15(6.8%)	28 (12.6%)
Moderate NPDR	33(14.9%)	25(11.3%)	58 (26.1%)
Severe NPDR	16(7.2%)	7(3.2%)	23 (10.4%)

Age, duration of diabetes mellitus, sex, dyslipidemia, FBS, blood pressure, and creatinine level were associated with the degree of diabetic retinopathy (p value <0.25), and type of diabetes mellitus, duration of diabetes mellitus, history of neuropathy, and type of diabetes medication were associated with vision-threatening diabetic retinopathy (p value <0.25). Patients who had diabetes for 5 years or 5-10 years had a 17- or 50-fold increased risk of developing diabetic retinopathy, respectively. (AOR = 17.5; 95% CI: 1.13-269.4; and AOR = 49.9; 1.85-1343.3) (Table 5 and 6)

Table 5: Bivariate and multinomial logistic regression analyses of factors associated with diabetic retinopathy between March 2022 and September 2022 (n=222)

Variable			COR	P value	AOR	P value
	Yes	No	(95% CI)		(95%CI)	
Age						
20-30	4	4	0.308(0.069-1.372)	0.12	0	0.99
31-40	16	7	0.703(0.246-2.01)	0.51	0.892(0.27-28.9)	0.94
41-50	38	9	1.299(0.519-3.252)	0.58	0.13(0.005-3.958)	0.24
51-60	59	17	1.068(0.491-2.325)	0.87	0.665(0.58-7.59)	0.74
>60	52	16	1		1	
Sex						
Male	96	20	2.17(1.152-4.088)	0.017	1.22(0.195-7.68)	0.83
Female	73	33	1		1	
Type of diabetes						
Type I	34	10	1.083(0.494-2.372)	0.842		
Type II	135	43	1		1	
Duration of diabetes						
<5years	27	17	0.36(0.16-0.8)	0.013	17.5(1.13-269.4)	0.04
5-10years	29	15	0.43(0.19-0.99)	0.048	49.9(1.85-1343.3)	0.02
11-15years	38	4	2.15(0.67-6.84)	0.194	1.36(0.8-22.36)	0.826
>15years	75	17	1		1	
Type of diabetes medication						
Dietary management	5	1	1.47(0.14-15.67)	0.749		
Oral hypoglycemic agent	72	30	0.71(0.24-2.01)	0.529		
Insulin	75	17	1.29(0.42-4.01)	0.651		
Both oral hypoglycemic agent and insulin	17	5	1			
History of hypertension						
Yes	103	30	0.836(0.45-1.56)	0.57		
No	66	23	1			
History of dyslipidemia						
Yes	53	22	1.55(0.82-2.93)	0.18	0.74(0.12-4.52)	0.74
No	116	31	1		1	

History of neuropathy						
Yes	21	6	0.83(0.343-2.36)	0.83		
No	148	47	1			
Adequate physical activity						
Yes	62	27	1.79(0.96-3.34)	0.66		
No	107	26	1			
Blood pressure						
Normal	75	18	0.645(0.33-1.22)	0.182	0.59(0.76-4.68)	0.62
High	94	35			1	
Body mass index						
FBS	163	48	0	0.99		
<126 mg/dl	78		0.495(0.258-0.952)	0.035	15.7(1.8-135.9)	0.12
>= 126 mg/dl	133		1		1	
HbA1C						
<6.5%	6	3	0.667(0.15-2.96)	0.594		
>=6.5%	51	17	1			
Total cholesterol						
<=200 mg/dl	37	13	0.712(0.133-3.793)	0.690		
>200 mg/dl	8	2	1			
Triglyceride						
<=180 mg/dl	32	12	0.889(0.21-3.85)	0.875		
>180 mg/dl	9	3	1			
High density lipoprotein						
>=30 mg/dl	15	6	0.69(0.2-2.356)	0.55		
<30 mg/dl	29	8	1			
Creatinine						
0.6-1.3 mg/dl	33	15	0.314(0.63-1.56)	0.157	3.053(0.4-23.06)	0.27
>1.3md/dl	14	2	1		1	

Table 6: Bivariate and multinomial logistic regression analyses of factors associated with vision-threatening diabetic retinopathy March 2022-September 2022 (n=222)

Variable	VTDR		COR	P value	AOR	P value
	Yes	No	(95% CI)		(95%CI)	
Age						
20-30	1	3	0.33(0.33-3.42)	0.35		
31-40	7	9	0.78(0.25-2.4)	0.66		
41-50	21	17	1.23(0.53-2.86)	0.62		
51-60	28	31	0.9(0.43-1.91)	0.79		
>60	26	26	1			
Sex						
Male	50	45	1.318(0.72-2.43)	0.376		
Female	33	40	1			
Type of diabetes						
Type I	20	14	1.63(0.76-3.49)	0.207	0.73(0.29-1.78)	0.49
Type II	63	72	1		1	

Duration of diabetes						
<5years	11	16	0.484(0.198-1.185)	0.112	1.52(0.59-3.95)	0.38
5-10years	11	18	0.431(0.179-1.038)	0.06	2.15(0.87-5.32)	0.95
11-15years	17	21	0.57(0.26-1.25)	0.162	1.64(0.72-3.73)	0.23
>15years	44	31	1		1	
Type of diabetes medication						
Dietary management	2	3	0.278(0.35-2.204)	0.225	4.23(0.48-37.3)	0.19
Oral hypoglycemic agent	29	43	0.281(0.89-0.883)	0.03	3.21(0.98-10.49)	0.53
Insulin	40	35	0.476(0.153-1.485)	0.201	2.28(0.69-7.5)	0.17
Both oral hypoglycemic agent and insulin	12	5	1		1	
History of hypertension						
Yes	54	49	0.711(0.38-1.324)	0.282		
No	29	37				
History of dyslipidemia						
Yes	23	30	1.39(0.72-2.68)	0.316		
No	60	56				
History of neuropathy						
Yes	13	8	0.552(0.216-1.41)	0.215	1.63(0.61-4.37)	0.325
No	70	78	1		1	
Adequate physical activity						
Yes	29	33	1.159(0.62-2.169)	0.644		
No	54	53				
Blood pressure						
Normal	51	43	0.74(0.4-1.36)	0.38		
High	35	40	1			
Body mass index						
FBS						
<126 mg/dl	28	26	1.18(0.62-2.27)	0.62		
>= 126 mg/dl	52	57	1			
HbA1C						
<6.5%	0	6	0	0.99		
>=6.5%	21	30	1			
Total cholesterol						
<=200 mg/dl	12	25	1.44(0.25-8.22)	0.68		
>200 mg/dl	2	6	1			
Triglyceride						
<=180 mg/dl	8	24	1.17(0.2-6.805)	0.86		
>180 mg/dl	2	7				
High density lipoprotein						
>=30 mg/dl	3	12	0.56(0.13-2.47)	0.44		
<30 mg/dl	9	20	1			
Creatinine						
0.6-1.3 mg/dl	11	22	0.9(0.24-3.34)	0.87		
>1.3mg/dl	5	9	1			

Discussion

The prevalence of diabetic retinopathy in our study was 76.1%, which is higher than that reported in studies performed in Gonder (16.2%) (24), Addis Ababa (21.6%) (23), and Iraq (33.2%) (28), possibly because the study was performed in a retina clinic where patients are referred for retina examination and additionally studies in Gondar and Addis Ababa dealt only on type II diabetes unlike our study which dealt on both types of diabetes. Of all patients, 81.1% of patients had a history of previous diabetic retinopathy screening which will be crucial in early detection of diabetic retinopathy. The most common comorbid condition with diabetes was hypertension in 59.9% of our study participants that comparable with study done in Iraq (44%), Nigeria (69.6%) and Gondar (50.2%). (17, 18, 24). Most of our patients had PDR (27%) and moderate NPDR (26.1%) in the worst eye. This finding is relatively higher compared to studies from Nigeria (3.7%) and Addis Abeba (16.7%). (18,23). This might be explained by the Addis Ababa study focused more on selected type II diabetes patient and the study from kano Nigeria was much lower than from our study and might be due to economic and awareness difference between the two study population.

PDR is also common among smokers despite the relatively low number of smokers. In this study, 40.1% of the participants were adhered to regular exercise which is lower than the study done in Jimma which showed 55.5% of the participant were adhere to regular exercise. (22)

Blindness in the worst eye occurred in 31.4% of diabetic retinopathy patients, which is greater than in studies performed in Gondar (15.2%) and Nigeria (6%). (18,24). This might be explained by most patients with vision threatening diabetic retinopathy (VTDR) referred to Menelik Hospital from all over the country for final intervention. Other causes of visual impairment other than diabetic retinopathy were found and the most common of which was cataracts. Additionally, cataract surgery was performed on 18.5% of patients. Similar to studies done in Iraq, Nigeria, Gondar and Cameroon; patients with duration of diabetes greater than ten years are at greater risk for developing DR (17,18,24,28).

Conclusion

The prevalence of diabetic retinopathy and VTDR at Menelik II Referral Hospital was high. A duration of diabetes of 10 years was associated with the presence of diabetic retinopathy. More than half of diabetic patients have poor glycemic control, and additional risk factors that contribute to diabetic retinopathy development and progression are common.

Therefore, we can conclude from this study that diabetic retinopathy is a visually threatening eye condition that needs due attention.

Limitation of study

The study was done for a short period and will give a narrow spectrum of the problem. There was no OCT machine in the hospital and it was difficult to diagnose macular edema objectively as a result we used clinical examination to diagnose diabetic macular edema.

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Consent to Publication

There was no confidential data or photo of the participant, only informed consent was addressed.

Authors contribution

Dr. Feven Feleke was a principal investigator who collected and analyzed data and Dr. Dereje Negussie was co-investigator.

Conflict of interest

There was no conflict of interest while conducting this study.

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Data availability

Data will be made available upon reasonable request

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