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Research Article

The Prevalence of Diabetic Retinopathy in Nasr Eldin Karam-Allah Center at Atbara Teaching Hospital

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Received: December 20, 2020

Abstract

Background: Diabetic eye malady is a health disorder in which impairment to the retina occurs because of diabetes mellitus, as a foremost reason of impaired vision.

Objectives: To assess the prevalence of diabetic retinopathy in Nasr Eldin Karamaalah Center at Atbara Teaching Hospital.

Methodology: this is a descriptive, prospective, cross-sectional hospital based study conducted at Nasr Eldin Karamaalah Center at Atbara Teaching Hospital (River Nile State) during the period from October 2018 to March 2019. The sample size was 221. The informations was collected by a questionnaire.

Results: 31 (57.4%) out of 54 studied cases had non proliferative diabetes retinopathy and 23 (42.6%) out of 54 studied cases had proliferative diabetic retinopathy. Diabetes retinopathy was higher in females 33 (61.1%) than males 21 (38.9%). Diabetic retinopathy was reported in 21 (38.9%) of the patients aged 61 - 70 years, 15 (27.8%) of the patients aged > 70 years, 10 (18.5%) aged 51 - 60 years, 5 (9.3%) aged 41 - 50 years and 3 (5.6%) aged 31 - 40 years. Incidence of diabetic retinopathy was higher in patients with longer duration of diabetes mellitus 29 (53.7%) than the patients with duration 10 years or less 25 (46.3%). Patients with uncontrolled diabetes (HbA1c) had higher prevalence of diabetes retinopathy 34 (63%) than patients with controlled diabetes 20 (37%).

Conclusion: Female gender, older ages, duration of diabetes mellitus and poor diabetes were associated with the prevalence of diabetic retinopathy (P value < 0.05).

Keywords: *Diabetic Retinopathy; Atbara; River Nile State; Sudan*

Introduction

Diabetic retinopathy (DR) is a condition in which retina has been damaged due to diabetes mellitus (DM) and characterized by signs of retinal ischemia such as micro aneurysms, haemorrhages, cotton-wool spots (CWS), intraretinal microvascular abnormalities (IRMAs), venous calibre abnormalities and neovascularization and signs of increased retinal vascular permeability [1]. DR is a leading cause of blindness [1]. The visual impairment inevitably leads to compromise the ability of the patients to manage successfully the disease [2]. DM

has a 25 times increased risk of blindness, especially in those with long duration of diabetes [3]. It has been estimated that in patients with DM for more than 20 years, retinopathy occurs in 77% of the patients [3].

According to the International Clinical Disease Severity Scale (ICDSS), DR has been classified into non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR) [4]. PDR is further classified into mild, moderate, and severe [4]. NPDR classified into mild, moderate, severe and very severe categories. This stratification reveals the jeopardy of development to proliferative retinopathy, which impacts follow-up intervals and treatment strategies. Whereas the one-year risks of progression to proliferative retinopathy for mild and moderate non-proliferative retinopathy are 5 and 15 percent, respectively, the severe and very severe categories have one-year risks of 52 and 75 percent respectively [5].

Non-proliferative retinopathy (NPDR) involves of a mutable presentation of nerve-fiber layer infarcts (cotton wool spots), intraretinal hemorrhages and hard exudates, and microvascular anomalies (counting microaneurysms, occluded vessels, and dilated or tortuous vessels) chiefly in the macula and posterior retina. The main reason of visual loss in NPDR is macular edema (ME) [5].

Proliferative diabetic retinopathy (PDR) is marked by the presence of neovascularization (NV) arising from the disc vessels and/or other retinal vessels. The consequences of these NV include preretinal and vitreous hemorrhages, retinal and preretinal fibrosis, and traction retinal detachment. There is a 75 percent five-year risk of progression from early to high risk stages [6].

Great jeopardy PDR is well-defined by reasonable to severe neovascularization of the optic disc (greater than 1/3 to 1/2 disc area), any neovascularization of the optic disc if vitreous or preretinal hemorrhage is existing, or reasonable to severe neovascularization elsewhere on the retina (at least 1/2 disc area) if vitreous or preretinal hemorrhage is existing. Untreated great jeopardy proliferative retinopathy consequences in a 60% risk of severe blindness at five years period [6].

Macular edema (ME) can happen at any stage of diabetic retinopathy. It is known as retinal thickening and edema involving the macula and it may be visualized by specific fundus examination by stereoscopic inspecting, fluorescein angiography and most directly by optical coherence tomography (OCT; a non-invasive low energy laser imaging technology [6].

Clinically important macular edema (CSME) is recognized as retinal thickening within 500 microns of the fovea, hard exudates within 500 microns of the fovea if linked with adjacent retinal thickening, or one or more parts of retinal thickening at least 1500 microns in diameter that is within one disc diameter (1500 microns) of the fovea [6].

There are many risk factors for DR including chronic hyperglycemia [6], impaired autoregulation of retinal blood flow [7], Sorbitol [8], advanced glycosylation end products [9], retinal microthrombosis [10], growth factors and the interaction between IGF-1 and VEGF [11,12], carbonic anhydrase [13], genetic factors [14], ethnic factors [15] and medications e.g. rosiglitazone and Thiazolidinediones [16].

According to the World Health Organization (WHO), it is estimated that DR accounts for 4.8% of the number of cases of blindness (37 million) worldwide [17]. A pooled analysis of 22 896 people with diabetes from 35 population-based studies in the U.S., Australia, Europe and Asia (between 1980 - 2008) showed that the overall prevalence of any DR (both types; T1MD and T2DM) was 34.6% (95%CI 34.5 - 34.8), with 7% (6.9 - 7.0) VTDR [18].

In Europe, 50% of T1DM with no DR at baseline had been shown to develop retinopathy by 5 to 7 years, and 9% with mild NPDR would develop PDR by 5 years [19].

On the other hand, the US WESDR showed the 10-year DR incidence in T1DM was 74%, increasing to 97% after 25 years. Of those who had any DR at baseline, the incidence of DR progression (2+ steps progression on Early Treatment Diabetic Retinopathy Study [ETDRS] scale) was 64% at 10 years and 83% at 25 years duration [20].

Yearly estimations of the 25-year WESDR study have shown a drop in PDR and DME occurrence in the last half of the study matched to the first 12 years [21].

The prevalence of Diabetes mellitus (DR) is significantly associates with aging, high blood glucose concentration and high HbA1c concentration [6]. DR occurs throughout the world, but it is more common in the more developed countries. The highest rise in prevalence is, though, probable to arise in Asia and Africa, where most patients will probably be found by 2030. The upsurge in commonness in developing countries chases the propensity of civilization and lifestyle alterations, perhaps most importantly a "Western-style" diet. This has proposed an ecological influence, but there is slight sympathetic of the method (s) at current, however there is much speculation, some of it most interestingly presented [22].

In Sudan there were more than 1.4 million cases of diabetes in 2015 according to International Diabetes Federation [22]. Understanding the prevalence of diabetic retinopathy are important for diabetic control programs and for the decision and policy makers.

Methodology

This is a descriptive cross-sectional hospital-based study. The study included all diabetic patients above 30 years attending Diabetics Center in ATH-Sudan during October 2018 to March 2019, these were 221patients. Specially designed (interview) questionnaire was used. Specific investigations and full fundal examinations were done. The data include the gender, age which divided into five subgroups; started 31 - 40, 41 - 50, 51 - 60, 61 - 70 and more than70, control of DM was depended on the HbA1c level, the duration of the DM divided into two groups; first ten years and more than 10 years while the type of DR is depended on the presence of neovascularization during fundal examinations.

The purpose of the study was explained to the patients and written consents were taken.

Data was analyzed and interpreted using the Statistical Package for Social Sciences (SPSS) version14. Chi squire test was used and the significant difference (P-value) was adjusted with confidence interval (CI) 95%.

Results

The characteristics of the study population and the outcome of the study are in table 1.

Factors		% among total DM patients	% among DR patients	P-value
	Number	221	54 (24.4%)	
Gender	Male	41.20%	21 (38.9%)	
	Female	58.8	33 (61.1%)	< 0.002
Age of patients	31 - 40 years	15.80%	3 (5.6%)	0.004
	41 - 50 years	16.70%	5 (9.3%)	
	51 - 60 years	28.10%	10 (18.5%)	
	61 - 70 years	23.10%	21 (38.9%)	< 0.05
	> 70 years	16.30%	15 (27.8%)	
Duration of DM	Duration ≤10yrs	56.60%	25 (46.3%)	
	Duration > 10yrs	43.40%	29 (53.7%)	
Control of DM	Controlled HbA1c	68.3	20 (37%)	
	Uncontrolled HbA1c	31.70%	34 (63%)	< 0.05
Type of DR	NPDR	31 (14%)	57.40%	
	PDR	23 (10.4%)	42.60%	

Table 1: *Show the characteristics of the sample and the outcome of the study.*

Discussion

The result of the overall prevalence of DR was 24.4% which is low when compared to the result of a pooled analysis of 22 896 people with diabetes from 35 population-based studies in the U.S., Australia, Europe and Asia (between 1980 - 2008) which showed that the overall prevalence of any DR (Type1 DM (T1DM) and Type2 DM (T2DM)) was 34.6% [18]. The result is low when compared to another study carried in outpatient of 3 general hospitals states in Sudan in 2012 for insulin-treated diabetic patients revealed that the prevalence of DR was 43% [23]. Again, the result is significantly low when compared to the frequency of DR in Cameroon which was 54.1% among patients on anti-diabetic medication and 73.9% among those on insulin treatment, giving an overall frequency of 57.5% [24].

Also, the result is low when compared to the prevalence rates in South Africa; in which the rates for retinopathy, pre-proliferative diabetic retinopathy (PDR) and PDR were 24.9%, 19.5% and 5.5% [25]. Also, the result is low when compared to the prevalence of DR in Tanzania (27.9%) [26]. The result is significantly low when compared to the prevalence of DR in Ethiopia (41.4%) [27] and to the prevalence in Kenya (35.9%) [28].

The results is low when compared to the results of a study done by Khan., *et al*. in which they evaluated the prevalence of diabetic retinopathy (DR) in the urban and rural areas of Al Hasa region of Saudi Arabia and looked to determine the risk factors related to DR. The prevalence of DR among 473 diabetic subjects was 30% [29].

While the result is significantly higher than the estimated prevalence of DR in Sudan in 2011 (around 17.2%) [30]. Also, the result is higher than the result of study done by Rodriguez-Poncelas., *et al*. in which they evaluated the prevalence and severity of DR and associated risk factors in patients with type 2 diabetes (T2DM) screened in Catalan Primary Health Care. 108723 persons with T2DM had been monitored with retinal photography. The prevalence of any kind of DR was 12.3% [31].

Patients aged above 50 years had significantly higher prevalence of diabetic retinopathy than younger patients (P value < 0.05). This result is same as a study done by Liu., *et al*. who explored the risk factors of diabetic retinopathy (DR) and sight-threatening diabetic retinopathy (STDR) among Chinese patients with diabetes and found that the older age is risk factor for diabetes retinopathy [32]. The result is also near to the results of Elwali., *et al*. study [33] in which they found that the mean age of DR was 58.7 ± 10.5 years. Also, Ibrahim [34] study showed that 55 - 64 year old diabetic patients were more affected with diabetic retinopathy.

The results is different from the result of the study done by Macky., *et al*. in which they studied the prevalence and the determinants of diabetic retinopathy (DR) in patients equal to or more than 18 years old at the Cairo University and Sixth of October University hospitals. Their sample size was 1,325 patients with a mean age of 49 years (SD ± 12.9). They found that increasing age is associated with a non-significant increase in the rate of DR (p = 0.340) [35]. But this can be explained by that the ages of the patients in the sample were already elderly (mean ± SD is 49 ± 12.9).

The study revealed that DR is significantly more common in female than male (0.002). This result is similar to result of Macky., *et al*. [35] study in which they found the prevalence of DR was statistically significantly higher in females (p < 0.05). Also, the result is similar to result found by the study done by Elwali., *et al* [33].

The result is different from the results of study done in Kenya about the prevalence of DR and the associated factor and they found that DR was associated with male sex, duration and control of diabetes and treatment compliance [36]. The prevalence of DR has been found to be higher in those who had DM more than 10 years of duration (P value < 0.05). This result is comparable to Khan., *et al*. study in which they found that the prevalence of DR was associated with the duration of diabetes [29]. Same result was found in study done by Macky., *et al*. in which they found the prevalence of DR was significantly associated with longer diabetes disease duration (p < 0.001) [35]. Same result was found is study done by Elwali., *et al*. they assessed the frequency and associated risk factors of diabetic retinopathy among Sudanese individuals with diabetes attending Makka Eye complex in Khartoum, Sudan [33].

Also, the results is same as the result of study done by Ibrahim in Khartoum State aimed to reveal the impact of age, duration and control of Diabetes on risk of Diabetic Retinopathy. The study revealed that longer duration and poor control of diabetes were strongly associated with diabetic retinopathy [34].

DR occurred more in patients with uncontrolled diabetes (high HbA1c) 34 (63%) than controlled diabetes 20 (37%) (P value < 0.05), this result is similar to Khan., *et al*. result [29] and Ibrahim [34] study, both found that; the prevalence of DR was strongly associated to the uncontrolled diabetes. Also, the result is similar to United Kingdom Prospective Diabetes Study in patients with type 2 diabetes [4].

The result is different from the result of the study done by Ahmed., *et al*. in which they found that HbA1c levels are not significantly associated with retinopathy [37].

Conclusion

The prevalence of diabetes retinopathy among the studied patients was highly significant in female, duration of diabetes mellitus, old ages, and poor diabetes control patients.

Still DR in Sudan is deficient from epidemiological data and need more research about it.

Recommendations

- Awareness of diabetic patients should be raised about the importance of regular follow up at the ophthalmic clinics or referral to eye health care services from the primary health care center when they have any ocular or visual problems.
- Access tertiary level of healthcare services should be available to all diabetic patients in the all regions in Sudan.

Bibliography

1. Bandello F. "Epidemiology of diabetic retinopathy and macular oedema: a systematic review". *Eye* 18.10 (2016): 963-983.
2. Williams R., *et al.* "Epidemiology of diabetic retinopathy and macular oedema: a systematic review". *Eye* 18.10 (2016): 963-983.
3. Wild S., *et al.* "Global prevalence of diabetes: estimates for the year 2000 and projections for 2030". *Diabetes Care* 27.5 (2017): 1047-1053.
4. UK Prospective Diabetes Study Group. "Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38". *British Medical Journal* 317.7160 (2013): 703-713.
5. Aiello LM. "Perspectives on diabetic retinopathy". *American Journal of Ophthalmology* 136 (2013): 122.
6. Frank RN. "Diabetic retinopathy". *The New England Journal of Medicine* 350 (2004): 48.
7. Kohner EM., *et al.* "Role of blood flow and impaired autoregulation in the pathogenesis of diabetic retinopathy". *Diabetes* 44 (2015): 603.
8. Ko BC., *et al.* "An (A-C) n dinucleotide repeat polymorphic marker at the 5' end of the aldose reductase gene is associated with early-onset diabetic retinopathy in NIDDM patients". *Diabetes* 44 (2015): 727.
9. Brownlee M. "Lilly Lecture 1993. Glycation and diabetic complications". *Diabetes* 43 (2014): 836.

10. Boeri D., *et al.* "Increased prevalence of microthromboses in retinal capillaries of diabetic individuals". *Diabetes* 50 (2010): 1432.

11. Smith LE., *et al.* "Regulation of vascular endothelial growth factor-dependent retinal neovascularization by insulin-like growth factor-1 receptor". *Nature Medicine* 5 (2016): 1390.

12. Sharp PS., *et al.* "Long-term follow-up of patients who underwent yttrium-90 pituitary implantation for treatment of proliferative diabetic retinopathy". *Diabetologia* 30 (2017): 199.

13. Gao BB., *et al.* "Extracellular carbonic anhydrase mediates hemorrhagic retinal and cerebral vascular permeability through prekallikrein activation". *Nature Medicine* 13 (2007): 181.

14. The Diabetes Control and Complications Trial Research Group. "Clustering of long-term complications in families with diabetes in the diabetes control and complications trial". *Diabetes* 46 (1997): 1829.

15. Harris EL., *et al.* "Black-white differences in risk of developing retinopathy among individuals with type 2 diabetes". *Diabetes Care* 22 (2013): 779.

16. Kendall C and Wooltorton E. "Rosiglitazone (Avandia) and macular edema". *Canadian Medical Association Journal* 174 (2016): 623.

17. Resnikoff S., *et al.* "Global data on visual impairment in the year 2002". *Bulletin of the World Health Organization* 82 (2004): 844-851.

18. Yau JW., *et al.* "Global prevalence and major risk factors of diabetic retinopathy". *Diabetes care* 35 (2012): 556-564.

19. Burgess PI., *et al.* "Epidemiology of diabetic retinopathy and maculopathy in Africa: a systematic review". *Diabetic Medicine* 30.4 (2013): 399-412.

20. Klein R., *et al.* "The Wisconsin Epidemiologic Study of Diabetic Retinopathy: XXII the twenty-five-year progression of retinopathy in persons with type 1 diabetes". *Ophthalmology* 115 (2008): 1859-1568.

21. Klein R., *et al.* "The Wisconsin Epidemiologic Study of Diabetic Retinopathy XXIII: the twenty-five-year incidence of macular edema in persons with type 1 diabetes". *Ophthalmology* 116 (2009): 497-503.

22. Jonas JB., *et al.* "Prevalence and associated factors of diabetic retinopathy in rural central India". *Diabetes Care* 36.5 (2013): e69.

23. Elbagir MN., *et al.* "Pattern of long-term complications in Sudanese insulin-treated diabetic patients". *Diabetes Research and Clinical Practice* 30.1 (2013): 59-67.

24. Jingi AM., *et al.* "Association of insulin treatment versus oral hypoglycaemic agents with diabetic retinopathy and its severity in type 2 diabetes patients in Cameroon, sub-Saharan Africa". *Annals of Translational Medicine* 4.20 (2016): 395.

25. Webb EM., *et al.* "Screening in primary care for diabetic retinopathy, maculopathy and visual loss in South Africa". *Ophthalmologica* 235.3 (2016): 141-149.

26. Cleland CR., *et al.* "Diabetic retinopathy in Tanzania: prevalence and risk factors at entry into a regional screening programme". *Tropical Medicine and International Health* 21.3 (2016): 417-426.

27. Sharew G., *et al.* "Prevalence of diabetic retinopathy in Jimma University Hospital, Southwest Ethiopia". *Ethiopian Medical Journal* 51.2 (2013): 105-113.

28. Mathenge W., *et al.* "Prevalence and correlates of diabetic retinopathy in a population-based survey of older people in Nakuru, Kenya". *Ophthalmic Epidemiology* 21.3 (2014): 169-177.

29. Khan AR., *et al.* "Prevalence and Determinants of Diabetic Retinopathy in Al Hasa Region of Saudi Arabia: Primary Health Care Centre Based Cross-Sectional Survey, 2007-2009". *Middle East African Journal of Ophthalmology* 17.3 (2010): 257-263.

30. Elmahdi EM., *et al.* "Features of non-insulin-dependent diabetes mellitus (NIDDM) in the Sudan". *Diabetes Research and Clinical Practice* 11.1 (2011): 59-63.

31. Rodriguez-Poncelas A., *et al.* "Prevalence of diabetic retinopathy in individuals with type 2 diabetes who had recorded diabetic retinopathy from retinal photographs in Catalonia (Spain)". *British Journal of Ophthalmology* 99 (2015): 1628-1633.

32. Liu Y., *et al.* "Risk factors of diabetic retinopathy and sight-threatening diabetic retinopathy: a cross-sectional study of 13 473 patients with type 2 diabetes mellitus in mainland China". *BMJ Open* 7 (2017): e016280.

33. Elwali ES., *et al.* "Frequency of diabetic retinopathy and associated risk factors in Khartoum, Sudan: population based study". *International Journal of Ophthalmology* 10.6 (2017): 948-954.

34. Ibrahim M. "Impact of Age, Duration and Control of Diabetes on Risk of Diabetic Retinopathy among Sudanese Diabetic Patients in Khartoum, Sudan- 2016: Hospital based Cross-Sectional study". *The International Journal of Sciences: Basic and Applied Research* 33.1 (2017): 1-4.

35. Macky TA., *et al.* "Epidemiology of diabetic retinopathy in Egypt: a hospital-based study". *Ophthalmic Research* 45.2 (2011): 73-78.

36. Mathenge W., *et al.* "Prevalence and correlates of diabetic retinopathy in a population-based survey of older people in Nakuru, Kenya". *Ophthalmic Epidemiology* 21.3 (2014): 169-177.

37. Ahmed MH Elwali., *et al.* "The relationship between diabetic retinopathy and nephropathy in Sudanese adult with diabetes: population based study". *Diabetes and Metabolic Syndrome: Clinical Research and Reviews* 11.1 (2017): S333-S336.

Volume 5 Issue 1 January 2021