Correlation between Risk Factors and Severity of Diabetic Retinopathy in Patients with Type 2 Diabetes Mellitus In Tertiary Care Centre, Bastar District of Chhattisgarh

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ABSTRACT

BACKGROUND AND AIM

Diabetic Retinopathy (DR) is a chronic sight threatening state and a major cause of blindness worldwide. It affects 10% of patients with diabetes. It is therefore important to intensively control the risk factors of DR to reduce the onset and progression of DR. The study is aimed to assess the correlation between severity of DR with lipid profile, BMI, HbA1c and blood pressure among the type 2 diabetic patients at the GMC and Hospital, Jagdalpur.

METHODS

This was a prospective study involving 100 diabetic patients diagnosed with DR conducted over duration of six months. Retinal findings were correlated to serum fasting lipids levels, blood pressure, body mass index and HbA1c values.

RESULTS

This study included 100 participants with DR. Systolic blood pressure, Triglyceride levels and HbA1c were significantly associated with DR progression (0.015), (0.0009), (0.0090). Other parameters, including gender, high-density lipoprotein cholesterol, low-density lipoprotein, total cholesterol levels, body mass index, age were not significantly associated with DR.

CONCLUSION

Elevation in serum triglyceride levels and systolic blood pressure and HbA1C showed a statistically significant association with diabetic retinopathy. Controlling these factors may help preventing progression and occurrence of diabetic retinopathy among diabetic patients.

KEYWORDS

Diabetic retinopathy, Retinopathy, Lipid profile, DR, Dyslipidemia

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How to Cite This Article:
Singh A, Amin S, , Shori C, Kujur MK. Correlation between risk factors and severity of diabetic retinopathy in patients with type 2 diabetes mellitus In Tertiary Care Centre, Bastar district of Chhattisgarh. J Evid Based MedHealthc 2023;10(02):1-4.

Received: 03-May-2023;
Manuscript No: JEBMH-23-97522;
Editor assigned: 05-May-2023;
PreQC No. JEBMH-23-97522 (PQ);
Reviewed: 19-May-2023;
QC No. JEBMH-23-97522;
Revised: 26-May-2023;
Manuscript No. JEBMH-23-97522 (R);
Published: 06-Jun-2023;
DOI: 10.18410/jebmh/2023/10/02/80.

INTRODUCTION

Diabetic Retinopathy (DR) is a potential vision threatening micro-vascular complication in nearly 10% of patients with diabetes [1,2]. Therefore, DR is clinically of a huge concern. As DM morbidity causes increase in micro-vascular complications so DR prevalence is predicted to reach 5.4% by 2025 [3]. It is important to recognize and control the risk factors for DR in order to reduce the onset and progression of DR. Several risk factors for DR have been identified, including the duration of DM, glucose levels, blood pressure, serum creatinine and lipid profile [4,5].

Diabetic retinopathy can be categorized into Non-Proliferative Diabetic Retinopathy (NPDR) and Proliferative Diabetic Retinopathy (PDR) based on its stage and severity [6]. NPDR is further classified as very mild, mild, moderate, severe and very severe. Studies conducted in the past have reported that possible markers for DR progression and the occurrence of diabetic macular edema are due to Dyslipidemia - high serum levels of total cholesterol (TC), Triglycerides (TG), Low-Density Lipoprotein Cholesterol (LDL-C), and High-Density Lipoprotein Cholesterol (HDL-C) [7].

In the past several studies have been conducted to identify factors associated with DR progression wherein it was found that dyslipidemia is significantly related to severity of DR. A previous study of 140 patients with type 2 diabetes was conducted to determine the correlation between the severity of DR, and serum lipid and other modifiable risk factors found that high cholesterol level, blood pressure, renal function, and urine albumin excretion are significantly associated with the progression of DR. In addition, the Chennai Urban Rural Epidemiological Study by Rema, et al. which included 1763 Indian type 2 diabetic subjects suggested that serum triglycerides are associated with the risk of DR, while LDL-C was associated with DME [8-10]. The correlation of lipid profile, blood pressure, BMI, HbA1C with severity of diabetic retinopathy is still unclear especially in rural backgrounds of India. Although several studies have been conducted on this topic, the relationship between lipid profile, blood pressure, and DR is remarkable. Our study aimed to investigate the correlation between lipid profile and blood pressure, BMI and HbA1C with the development and severity of DR among type 2 diabetic patients presenting at Department of Ophthalmology, Lt BRKMGMC, Jagdalpur, Chhattisgarh.

METHODOLOGY

This prospective and observational study was conducted in the Department of Ophthalmology at Lt. BRKM GMC Jagdalpur, Chhattisgarh over a span of 6 months from January 2022 to June 2022 in accordance with the ethical standards of the institute. All the participants provided written informed consent prior to undergoing all examinations. Patients with Type 2 DM with DR, who met the eligibility criteria, were included in the study. The medical records of 100 diabetic patients with retinopathy were reviewed. Patients aged 40 years and above with known type 2 diabetes mellitus and diagnosed with DR were included in the study. Gestational Diabetes, patients with any recent ocular infection or surgery were under the exclusion criteria. All subjects underwent a complete physical examination and all findings were noted. Demographic data, such as age and gender, were collected from the medical records. Clinical examination was conducted by collecting clinical data, such as systolic blood pressure; diastolic blood pressure; BMI; recent glycated hemoglobin levels-HbA1C and fasting lipid profile, including total cholesterol, Triglycerides, Low-Density Lipoprotein (LDL), and High-Density Lipoprotein (HDL). Body Mass Index (BMI) was calculated for each patient using the BMI formula (weight in kg divided by square of person's height in meters). All patients underwent a complete ophthalmological examination of both eyes. The severity of DR was classified into very mild non-proliferative, mild Non-Proliferative DR (NPDR), moderate NPDR, severe NPDR, very severe NPDR, and PDR, according to the modified ETDRS - Early Treatment of Diabetic Retinopathy Study grading scale [11]. The primary outcome was the correlation between lipid profiles, blood pressure, HbA1C and DR. Data were registered in manual proformas and were entered in Microsoft Excel 2016, and statistical analysis was performed using Means and standard deviations were calculated. Student's t-test and chi-square testing done. Statistical significance was set at $p<0.05$. Multiple logistic regression analysis was performed with severity of DR stage as the dependent variable.

RESULTS

The study included 100 subjects in total and 66 patients were males and 34 were females. It is observed that 1% patient was aged 40 years, 18% patients were in the age range 41-50 years, 40% patients were in the age range 51-60 years, 28% patients were in the age range 61-70 years and 12% patients were in the age range 71-80 years. There were only 1% of patients had an age in range of 81-90 years. Hence it can be concluded that more than 71% of patients had an age greater than 50 years (Figure 1).

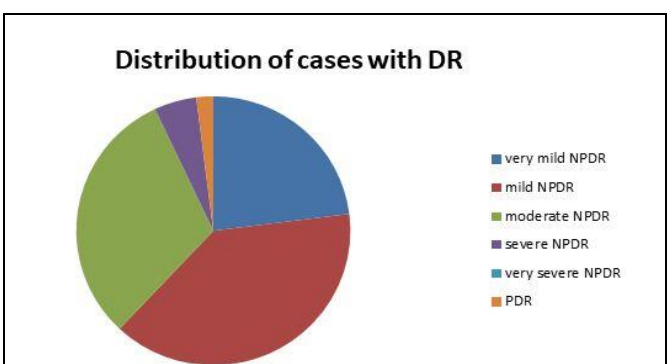

Figure 1. Distribution of Cases with DR {n=100}
Note: very mild NPDR=23; ( ) mild NPDR=39; ( ) moderate NPDR=31; ( ) severe NPDR=5; ( ) very severe NPDR=0; ( ) PDR=2 ( )

It was found that 23% subjects had very mild NPDR, 39% had mild NPDR, 31% had moderate NPDR, 5% had severe NPDR, and 2% had PDR. SBP (P=0.015) Triglyceride levels HbA1C (P=0.0090) were significantly associated with the severity of DR (P=0.0009). There was no significant relationship between the progression of DR and Total cholesterol, LDL, HDL, DBP and BMI (P=0.38868,(0.1525)(0.4219)(0.3140)(0.65929), respectively). Table 1 shows the results of multinomial logistic regression analysis to assess the independent predictors of DR stage.

Clinicopathologic Factors		Very Mild NPDR	Mild NPDR	Moderate NPDR	Severe NPDR	PDR (n=2)	F value/ Chi square test	Remark
		(n=23)	(n=39)	(n=31)	(n=5)		(P value)	
Gender	Male	20 (87%)	22 (56.4%)	20 (64.5%)	2 (40%)	2(100%)	8.667	Not Significant
	Female	3 (13.0%)	17 (43.6%)	11(35.5%)	3 (60%)	0 (0%)	-0.0699	
Age (Year)	Mean ± SD	60.4 ± 11.0	59.9 ± 8.37	57.7 ± 8.67	58 ± 7.48	69 ± 5.66	0.9619	Not Significant
	Range	(40-78)	(42-81)	(43-76)	(47-68)	(65-73)	-0.4321	
SBP	Mean ± SD	134.1 ± 13.9	139.9 ± 14.6	141.3 ± 17.3	146 ± 13.6	171 ± 12.7	3.25118	Significant
	Range	(110-160)	(90-170)	(110-180)	(136-168)	(162-180)	-0.015	
DBP	Mean ± SD	89.2 ± 9.34	87.2 ± 9.7	90.9 ± 9.6	88 ± 13.6	101 ± 1.4	1.411	Not Significant
BMI	Mean ± SD	24.16 ± 2.51	24.0 ± 3.34	24.6 ± 3.16	24.8 ± 3.83	21.5 ± 0.71	0.6059	Not Significant
	Range	(20.5-30)	(18-30.1)	(19-32)	(22-31)	(21-22)	-0.65929	
Total Cholesterol	Mean ± SD	213.9 ± 48.1	215.6 ± 38.8	220.6 ± 48.4	255.6 ± 0.23.0	226± 11.3	1.0441	Not Significant
TG	Mean ± SD	131.65 ± 39.02	148.07 ± 44.37	161.19 ± 72.3	222.4. ± 19.7	295 ± 7.07	6.8236	Significant
	Range	(40-200)	(65-215)	(40-446)	(195-250)	(290-300)	-0.0009	
LDL	Mean ± SD	118.09 ± 51.0	112.49 ± 32.67	125.5 ± 44.8	130.2 ± 32.9	125.5 ± 9.2	1.7171	Not Significant
HDL	Mean ± SD	64.56 ± 17.61	67.85 ± 21.05	69.6 ± 16.8	83.2 ± 34.1	64.5 ± 14.8	0.9806	Not Significant
	Range	(28-105)	(35-134)	(40-105)	(42-134)	(54-75)	-0.4219	
HbA1c	Mean ± SD	7.78 ± 0.87	8.64 ± 1.10	8.27 ± 1.11	8.54 ± 1.61	9.9 ± 2.4	3.58625	Significant
	Range	(5.6-9.6)	(5.8-11.2)	(5.8-10.4)	(6.4-10.2)	(8.2-11.6)	-0.009	

Table 1. Correlation of Risk Factors with Severity of DR

DISCUSSION

The recent study done as an initiative of AIOS showed that prevalence of DR in India in 2014 was 21.7% [12].

Diabetes and its complications pose a very serious public health hazards and visually compromising problems. Therefore, it is an important purpose to identify and modify the risk factors for diabetes. Multiple studies have found a correlation between lipid fractions and macrovascular complications of diabetes (e.g., coronary artery disease) [13].

However, very few studies have focused on the association between serum lipids and microvascular complications such as DR. Our study which was conducted in a Tertiary Care Centre of Chhattisgarh aimed to assess the correlation between DR severity, lipid profile, glycosylated Hb, blood pressure & BMI among diabetic patients. Our analysis and interpretation showed a significant relationship between TG levels, SBP, HbA1C and DR severity, which is comparable to findings reported in other studies conducted in India. The significance of serum lipids in the development and progression of DR has been assessed worldwide; hyperlipidemia causes endothelial dysfunction by promoting oxidative stress and inflammatory response. Hyperlipidemia affects endothelial cells nitric oxide synthase thus reducing bioavailability of NO and breakdown of the blood retinal barrier, which leads to exudation of serum lipids and lipoproteins, resulting in DR changes. We found no significant association between serum total cholesterol, LDL, HDL, DBP and BMI with DR stage. In our study, SBP was associated with the presence and severity of DR. This result was consistent with the results of previous studies. Hypertensive patients had a more than two-fold risk of DR compared to only diabetic patients with normal blood pressure. This may be because the endothelium of the retinal capillaries is damaged in DR, and hypertension promotes endothelial disturbances. Glycosylated HbA1C levels were clinically significant. In HbA1C, glucose is bound non-enzymatically to a terminal portion of Hb chain which helps in its quantization. Poor glucose control and glycosylated Hb indicates long term blood glucose concentration.

There were a few limitations worth considering in this study. First, this was single- tertiary care center study an therefore further studies are needed to confirm whether the results are translatable to other healthcare settings. Second, the time of sampling and laboratory readings might vary which could further affect the results.

Therefore, further prospective studies are warranted to validate our results. Third, the small sample size due to single-center data considers an important drawback to mention and the number of included participants could be greater.

Nevertheless, the results described herein are valuable and significant as this is one of the first studies conducted to assess the correlation between both risk factors and severity of DR in Bastar Disctrict of Chhattisgarh.

CONCLUSION

In conclusion, our findings have clear clinical implications. Raised serum triglycerides, glycosylated haemoglobin, hypertension with raised SBP, have an impact on DR severity. There is a lack of association with other lipid parameters such as total cholesterol and HDL, BMI, DBP. We also found that systolic blood pressure was associated with DR progression. These observations help to clarify the need to control and modify these factors and also suggest that lipid targeting therapies may be more effective in slowing the progression of DR per se. the results highlight the importance of measuring lipid levels, blood sugar levels and blood pressure in patients with diabetes to initiate appropriate treatments and prevent the onset and progression of retinopathy.

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