Original Article

Forensic Aspect of Association of Low-density Lipoprotein and Retinopathy in Diabetic Patients

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Abstract

Introduction: Around 10% of people with diabetes are at risk of losing their eyesight due to diabetic retinopathy, which is a leading cause of blindness globally. Numerous studies have shown that limiting the incidence and progression of diabetic retinopathy requires thorough treatment of the risk factors for the disease in situations involving diabetic patients who have had retinopathy, forensic specialists are frequently requested to review medical data and offer expert testimony. In such circumstances, physicians may investigate the patient's medical history, taking into account their LDL levels and other risk factors, to see if medical malpractice or carelessness contributed to the development of retinopathy.

Aims: The objective is to develop medical provider guidelines, estimate the prospective association between low-density lipoprotein (LDL) and the risk of retinopathy in diabetic patients with type 2 diabetes, and look into any possible role for malpractice or negligence on the part of medical professionals.

Methods: This was a cross-sectional analysis of all 300 samples collected from patients diagnosed with diabetic retinopathy at the Dr. Ram Manohar Lohia Institute of Medical Sciences Lucknow. Using univariate, bivariate, and multivariate analyses, retinal results were associated with blood lipid levels.

Result: In diabetic patients with retinopathy, LDL values were considerably greater than in those without retinopathy (p 0.001). Studying the forensic aspects of the relationship between LDL and diabetic patients' retinopathy is crucial because it can enhance patient outcomes and guard against malpractice and mistakes in medicine.

Conclusion: Low-density lipoprotein cholesterol is a sensitive target marker to foretell cardiovascular events as well as the requirement for laser therapy in individuals with hypercholesterolemia and diabetic retinopathy. The judicial system's capacity to establish responsibility and pay damages in such situations may be affected by the use of LDL levels as a biomarker for predicting the development of retinopathy.

Keywords: Diabetic patients, Diabetic retinopathy, Low-density lipoprotein, Forensic retinopathy, etc.

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Introduction

Millions of individuals throughout the world are affected by diabetes, which is becoming more common.[1] Diabetes frequently causes diabetic retinopathy, an eye condition that if unchecked can result in blindness.[2] LDL cholesterol, a well-known risk factor for cardiovascular disease, is a kind of cholesterol that is frequently high in diabetics.[3] Recent research has demonstrated that diabetic people who have high levels of LDL are also at an increased risk of developing and worsening retinopathy.[4] In situations involving diabetic individuals who have had retinopathy, forensic medicine specialists are vital in reviewing medical data and offering expert testimony.[5] They analyze the patient's medical history, including their LDL levels and other risk factors, and look into whether medical misconduct or carelessness had a part in the development of retinopathy.[6] By doing this, forensic specialists can demonstrate a connection between LDL and retinopathy in a specific instance.[7] Guidelines for healthcare professionals to assist prevent and treat diabetic patients' retinopathy may also be developed by forensic specialists.[8]These suggestions may call for keeping an eye on LDL levels and giving diabetic people statins to decrease their cholesterol.[9]Such recommendations can enhance patient outcomes and reduce malpractice and medical mistakes.[10] Numerous researches have looked at the potential link between LDL and the likelihood of diabetic individuals developing retinopathy.[11] For instance, research reported in the American Journal of Ophthalmology revealed that diabetic individuals with high LDL levels had an increased chance of developing retinopathy.[12] In contrast to individuals with the lowest levels of LDL, those with the highest amounts had a noticeably increased chance of getting retinopathy, according to the study.[13] According to a different study that was published in Diabetes Care, reducing LDL levels in diabetic individuals decreased their chance of developing retinopathy.[14] The study discovered that individuals who received statin treatment, a class of drugs used to decrease cholesterol, had a lower chance of getting retinopathy than those who did not.[15] Studying the forensic aspects of the relationship between LDL and diabetic patients' retinopathy is crucial because it can enhance patient outcomes and guard against malpractice and mistakes in medicine.[16] When trials include diabetic individuals who have had retinopathy, forensic specialists are crucial in reviewing medical data and offering expert testimony.[17] They could also create recommendations for medical professionals on how to handle and prevent diabetic individuals' retinopathy. Decreased LDL levels in diabetic individuals may also minimize their chance of getting retinopathy, according to current research results.[18][19]

Material and Methods

A cross-sectional study was conducted at DRMLIMS tertiary care hospital between April 2019 and August 2020, where 300 participants were recruited through a questionnaire. The study collected data on the participant's age, gender, clinical symptoms, duration of diabetes, medication, and socioeconomic background. Fasting blood samples were taken to estimate ALDR-2, glucose levels, and lipid profiles. An auto-analyzer was used to assess only the low-density lipoprotein (LDL). The plasma glucose levels were measured through the Glucose Oxidase-Peroxidase technique. All tests were carried out on the same day at the Biochemistry Department of DR. RMLIMS, Lucknow, with informed consent obtained from all participants to conduct the study.

Inclusion criteria: We include all Type 2 Diabetic patients Aged>30 years<85 with retinopathy.

Exclusion criteria: The exclusion criteria included All Diabetic patients on insulin or statin therapy with anemia or liver disease were excluded from the study.

Statistical Analysis

The results are shown as Mean-SD. All categorical variables were compared using the Chi-square test. The unpaired t-test was used to compare the continuous study parameters between the two groups and subgroups. A 0.05 p-value was regarded as significant. For all of the analyses, IBM SPSS Statistics for Windows, version 22.0, was utilized.

Result

We include all the patients who qualified for the inclusion and exclusion criteria. Demographic, clinical, and ophthalmological evaluations of the patients were done. The distribution of patients according to retinopathy status is shown in Table 1 below:

Table 1: Distribution of patients according to retinopathy status

SN	Retinopathy Status	No. of patients	Percentage
1.	No retinopathy	195	65.0
2.	Retinopathy	105	35.0
	Grade 1	43	14.3
	Grade 2	36	12.0
	Grade 3	13	4.3
	Grade 4	9	3.0
	Grade 5	4	1.3

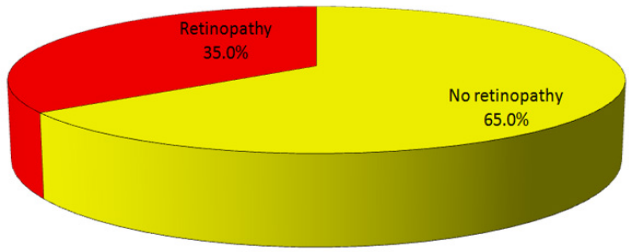

Fig. 1.1: Pie Diagram showing cases with and without retinopathy

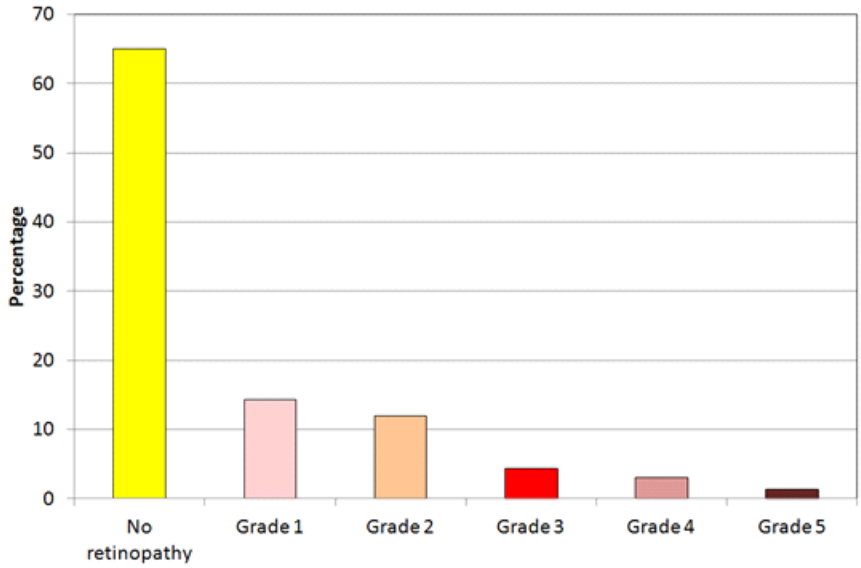

Fig. 1.2: Distribution of cases according to retinopathy status and its severity

Interpretation

Out of the 300 patients enrolled in the study, a total of 195 (65%) did not have retinopathy. The prevalence of retinopathy in our study was 35%. Out of 105 patients diagnosed with retinopathy, a maximum (n=43; 14.3%) had Grade 1 retinopathy, followed by Grade 2 (n=36; 12%), Grade 3 (n=13; 4.3%), Grade 4 (n=9; 3.0%) and Grade 5 (n=4; 1.3%) respectively (Table 1; Figs. 1.1 and 1.2).

Table 2: Comparison of Age and Sex Profile of patients with and without retinopathy

SN	Characteristic	Retinopathy (n=105)	No retinopathy (n=195)	Total (n=30)	Statistical significance
1.	Mean Age SD (Range) in years	56.20±12.82 (30-85)	52.82±11.56 (30-80)	54.01±12.10 (30-85)	't'=3.331; p=0.020
2.	Sex				
	Male	51 (48.6%)	80 (41.0%)	131 (43.7%)	χ^2=1.580; p=0.209
	Female	54 (51.4%)	115 (59.0%)	169 (56.3%)	

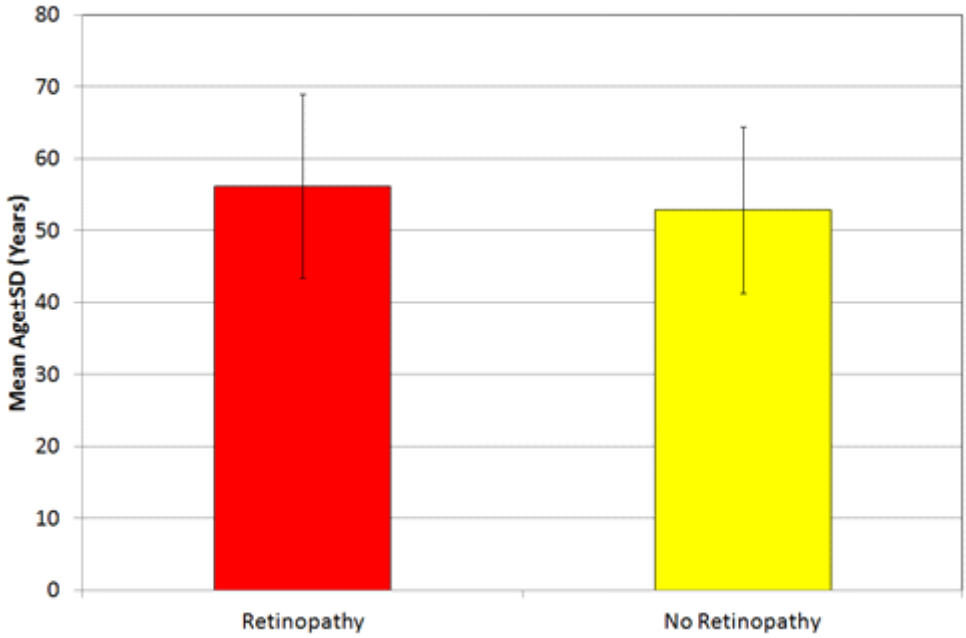

Fig. 2.1: Comparison of mean age of T2DM patients with and without retinopathy

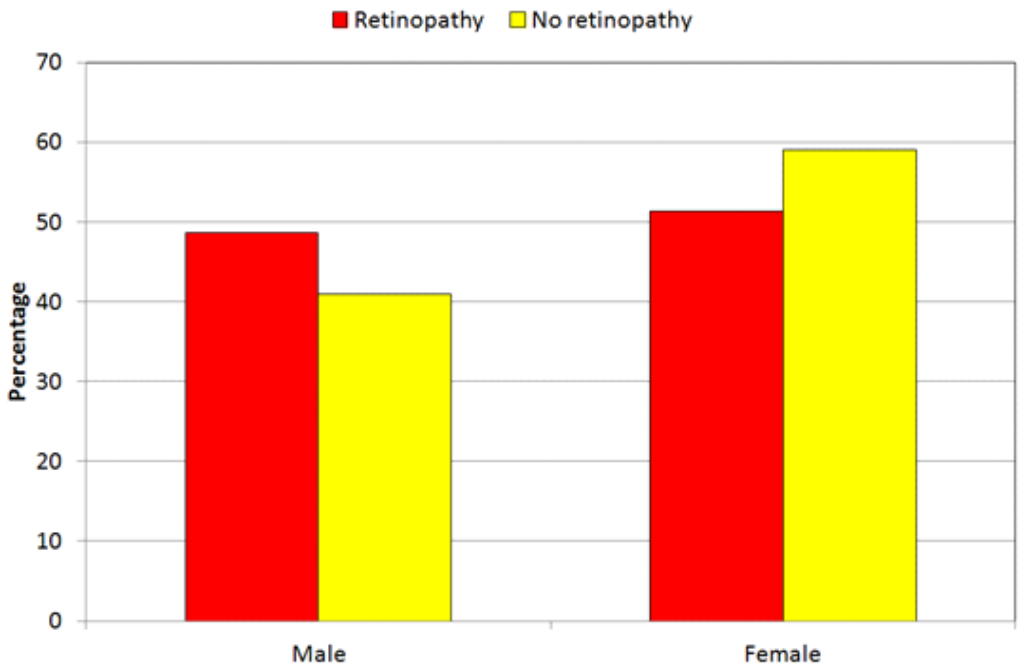

Fig. 2.2: Comparison of sex of patients with and without retinopathy

Interpretation

The age of patients ranged from 30 to 85 years. The mean age of patients was 54.01±12.10 years. The mean age of patients with retinopathy was higher (56.20±12.82 years) as compared to that of patients without retinopathy (52.82±11.56 years). Statistically, the difference in the mean age of patients in the two groups was significant (p=0.020).

Overall as well as in both groups majority of patients were males. The sex ratio of the study population was 0.78. Though the proportion of males was higher in retinopathy (48.6%) as compared to the non-retinopathy group (41%) yet this difference was not significant statistically (p=0.209).

Table 3: Significance of LDL Level in Retinopathy

SN	Variable	Retinopathy (n=105)		No retinopathy (n=195)		Total (n=300)		Statistical significance	
		Mean	SD	Mean	SD	Mean	SD	't'	'p'
1.	Low-density lipoprotein (mg/dl)	87.19	32.34	73.31	25.17	78.17	28.62	4.112	<0.001

Interpretation

The study found a substantial correlation between LDL levels and diabetic retinopathy. When compared to patients without retinal, those with retinopathy had noticeably higher LDL values (p 0.001). This study may have forensic ramifications since it suggests that high LDL levels may have a role in the progression of diabetic retinopathy. This knowledge may be significant in cases involving diabetes and associated consequences, especially when lowering LDL levels is a key consideration.

Discussion

These findings imply a potential role for elevated LDL cholesterol levels or a decreased HDL to LDL cholesterol ratio in the etiologic of diabetic retinopathy.[20]However, since altered lipid metabolism may not be the actual cause of microangiopathy but rather one of its consequences, evidence could only come from prospective research.[21]There is proof that individuals with type 2 diabetes have an increased risk of cardiovascular events when their LDL cholesterol levels are higher, according to a meta-analysis of prospective research by Sniderman AD et al and Seshasai SR et al. [22][23] Each 1 mmol/L rise in LDL cholesterol resulted in a 30% increase in the risk of incident CVD and a 50% increase in the risk of CVD death.[22][23]At a median age of 81 years, 11376 (10.5%) of the 108243 participants aged 20 to 100 died during the research conducted by Johannesen CD et al. The relationship between LDL-C levels and the risk of all-cause mortality was U-shaped, with both low and high levels being linked to a higher risk of all-cause death.[24]According to the results of the investigation, the inverse correlation rather than indicating a lower risk at high levels of LDL-C can be explained by the higher risk of all-cause mortality linked to low levels of LDL-C. Additionally, recent research conducted by Sung KC et al among young Koreans who were not using lipid-lowering medication revealed a link between low levels of LDL-C and an elevated risk of death from all causes, cardiovascular disease, and cancer.[25] A study by Zeljkovic et al including 200 patients with acute ischemic stroke found that a greater concentration of tiny, dense LDL particles was linked to a higher risk of in-hospital death.[26] Low-density lipoprotein (LDL) cholesterol has been linked in the study of Klein R et al to retinopathy in diabetic individuals, potentially as a result of high LDL's negative effects on the blood vessels in the retina. According to this research, diabetic individuals' retinopathy may be exacerbated by high LDL levels.[27]In the retinas of diabetic mice models, aberrant blood vessel development has been linked to LDL, according to research by Roy S et al published in Investigative Ophthalmology & Visual Science. Forensic investigations should take note of this relationship. When a diabetic patient develops retinopathy, the patient's medical history and LDL levels should be taken into account. Retinopathy may be a sign of diabetes in people with a cardiovascular disease brought on by high LDL. There are significant forensic implications to the association between LDL and retinopathy.[28]

Limitation

It is difficult to prove a causative link between LDL and retinopathy since many studies are retrospective in nature, which limits the forensic element of the correlation between LDL and retinal in diabetes patients. Additionally, the connection may be muddled by patient-specific characteristics.

Conclusion

In those with hypercholesterolemia and diabetic retinopathy, low-density lipoprotein cholesterol is a sensitive target marker to predict cardiovascular events as well as the need for laser treatment. Medical and legal practitioners should both be familiar with

the forensic aspects of LDL-associated retinopathy. Identification of LDL in the retina can help with the diagnosis and prevention of retinopathy and other related health issues, which can have a substantial impact on people's health and well-being. It can also be determined any potential forensic ramifications of this association, particularly in cases of medical malpractice or wrongful death brought on by complications from diabetes

Conflict of Interest: There is no conflict of interest

Source of funding: None

Ethical clearance: The institutional ethics committee of the hospital gave its approval to the study protocol. All participants provided informed consent before the data was collected. It was promised to participants that their answers would be kept private and anonymous.

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