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A Clinical Study of Association Between Serum Lipid Profile and Diabetic Retinopathy

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Abstract

Introduction: Diabetic retinopathy plays a main role in adult blindness. Early identification of diabetes mellitus and its risk factors will result in decreasing complications .The aim of this study is to identify the association between the lipid profile with the diabetic retinopathy severity.

Methods: This study comprises cases of 200 number type II diabetes mellitus (100 cases of diabetic retinopathy and 100 cases of normal fundus) and control with 100 number with age/sex matched were examined ophthalmologically. Fundus were dilated and examined with ophthalmoscopy and slit lamp biomicroscopy. Grading of severity of retinopathy calculated by ETDRS classification. Lipid profile analyzed using biochemical method.

Results: There was significant association between serum cholesterol level and diabetic retinopathy. Visual acuity was not affected.

Conclusions: Hypercholesterolemia may acts as one of the risk factor in diabetic retinopathy and also CSME.

Keywords: Hypercholesterolemia; Diabetic Retinopathy; Ophthalmoscopy.

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Introduction

Diabetes mellitus emerging highly epidemic in India, currently an approximate of 62 million individuals diagnosed [1,2]. According to WHO, diabetic retinopathy is responsible for 3-7% of the total blindness in Asia [3]. The prevalence of diabetic retinopathy in Indian population is apprximately 3.5% and incidence of diabetic retinopathy in diabetic population was 18.0% [6]. In a study by Wild et al., demonstrated that the incidance of diabetes mellitus will double from 171 million to 366 million in the year 2030 [4]. According to World Diabetes Atlas Indians were projected to have around 51 million diabetes mellitus population4. There is a growing concern for Asia being the region for diabetic epidemic [5,6]. Diabetic retinopathy is preventable microvascular complication, leading risk factor of blindness [7]. It is a microvasculopathy. Diabetes retinopathy is observed both in type I and II diabetes mellitus.

Duration of DM is the predominant and age of the patient are the important risk factor for diabetic retinopathy development and prognosis. Other risk factors will be control of blood sugars, hypertension, dyslipidemia, microalbuminuria, BMI, kidney disease and smoking habits are associated with diabetic retinopathy progression [8,9,10].

Diabetic retinopathy accompanied by lipid exudation also accumulation in the retina11. Elevated serum lipid levels may increases risk of retinal hard exudates in diabetic retinopathy patients, retinal hard exudates accompanies diabetic macular edema, resultant may increase the risk of visual impairment [12].

The association between lipid levels with diabetic retinopathy has been studied in few. Some studies

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shows serum triglyceride levels may have the role in progression of diabetic retinopathy. Whereas other studies showing no correlation [13].

The diabetic retinopathy treatment was laser photocoagulation when it cauases CSME or in severe NPDR. Medical management will beneficial with lipid lowering drugs. There is some anecdotal evidence of the effect of lipid lowering drugs in reducing hard exudetes [11].

Current study designed to analyze the correlation of serum lipid profile with diabetic retinopathy.

Methodology

Current study done in ophthalmology department from January 2016 to December 2016. 300 patients who attending the OPD were included. The patients were divided into three groups. 100 patients with diabetic retinopathy kept in study group and 100 diabetic patients without changes in retina kept as control. 100 subjects with age and sex matched healthy persons were included as controls. Type II diabetes mellitus of more than 5 years duration, on medications, Age more than 40 years were included in this study. Patients with significant hazy media impairing fundus evaluation, pupillary abnormalities which prevented adequate dilatation for funduscopy, Patients on hypolipidemic drugs, treated earlier with either LASER, Intravitreal anti-VEGF injections were not included.

Both cases and controls were underwent a detailed ophthalmic evaluation; slit-lamp examination, BCVA and recorded using Snellen chart, dilated fundus examined for diabetic retinopathy. Diabetic retinopathy changes were graded into five classes on the basis of ETDRS classification.

Lipid profile: 5ml of fasting blood sample collected and lipid profile analysed including serum fasting total cholesterol, fasting triglyceride, fasting low density lipoprotein, high density lipoprotein.

The data obtained was compared with the grades of diabetic retinopathy and its association with each of the three groups. All group data were presented as frequency distribution and the average values were presented as mean±SD for the normal distribution data. p value less than 0.05 kept as significant.

Results

In our current study, the mean age group1, 2 and 3 were 60.79±6.85, 57.96±6.07 and 61.05±7.45 years.

In this study, 53 were of males and 47 were females.

Table 1: Age, Duration of diabetes and treatment

		Group 1	Group 2	Group 3
Age (years)		60.79±6.85	57.96±6.07	61.05±7.45
Duration of diabetes (years)		9.25±4.46	6.24±1.29	-
Treatment modality	Oral hypoglycemic drug	75%	78%	-
	insulin	26%	21%	-

In this study duration of diabetic age ranged from 5 years to 25 years. The disease duration in group 1 and 2 observed as 9.25±4.46 and 6.24±1.29 years. Oral hypoglycemic drugs were being used in group 1 and 2 were by 75% and 78% (Table 1).

Cataract was the most common ocular association.

The percentage of subjects with normal anterior segment in group 1, 2 and 3 are 20.0%, 28.0% and 23. There were no significant changes in anterior segment features among different groups.

According to the present study some degree of visual impairment was seen in patients of Group 1. However there was no statistical significance with p=0.9.

In group 1, mild, moderate and severe NPDR retinopathy in 43%, 30% and 11% of patients respectively; very severe NPDR in 7% and proliferative retinopathy in 9% of patients.

Table 2: Mean values of lipid prolife and sugar levels in each group.

Mean	Group 1	Group 2	Group 3
Total Cholesterol	228.15±31.5	212.28±38.12	162.45± 25.44
Triglycerides	239.55±65.53	178.92±20.44	128.45±14.2
HDL	46.7±9.25	52.22±12.97	53.45±7.88
LDL	96.29±25.55	132.78±16.49	102.12±18.25
FBS	135.73±55.45	104.47±35.37	83.45±12.54
PPBS	218.8±85.88	179.75±20.29	124.52±12.25

In this study, the mean cholesterol is higher in both groups 1 and 2. Group1 observed as higher when compare to group 2. Levels of Triglycerides also observed as higher in group 1 than group 2. Total cholesterol levels value had statistical significance p = 0.012 (Table 2).

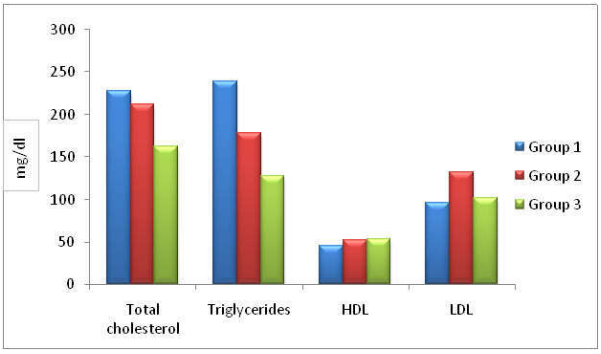

Fig. 1: Graph showing mean value of various lipid parameters in different groups

In this study, group 1 patients in all severity groups had increased total cholesterol levels and triglyceride levels. However, increased total cholesterol levels showing p value 0.016.

Total cholesterol levels observed as higher in patients with severe NPDR, very severe NPDR and PDR, when compare to subjects with diabetic retinopathy (p =0.046).

In this study, it is evident that most of the subjects in group 1 showing high blood sugar levels. Mean Fasting sugar levels and PPBS levels were higher in group1 when compared to group 2.

In lipid profile, diabetic retinopathy groups with and without CSME, observed to be cholesterol concentration was significantly higher in the retinopathy subjects with CSME when compared to without CSME (p=0.001).

Severity of diabetic retinopathy did not show a linear trend for the decreased visual acuity. As the patients were of geriatric age group, they had associated cataract causing visual impairment.

Discussion

Diabetes mellitus is the most common metabolic disorder in India.increasing prevalence of DM leads to macrovascular and microvascular complications. Diabetic retinopathy may leads to blindness. Persons with diabetes mellitus may have 20 to 25 times greater risk of blindness when compared to normal population. As the prevalence of diabetes is increasing, the incidence of diabetic retinopathy is also increasing [15]. Patients with diabetes mellitus commonly affected by dyslipidemia metabolic disorder. The role of dyslipidemia in diabetes mellitus for the development of microvascular complications is not fully understood [16]. Hence, our study designed to analyze the association between serum lipid profile and diabetic retinopathy severity.

In current study, 200 type II diabetes mellitus patients of ages ranging from 45-80 years as cases, also including 100 age and sex matched controls were analysed biochemically. The patients categorized according to with or without diabetic retinopathy and CSME.

In this study, the male to female ratio observed as 53:47. In a study, diabetic retinopathy incidence observed more in the males compared to females (sex ratio 2:1) [17] and also in the CURES Eye study [18], UKPDS study [19] Gupta et al. [20] and the Andhra Pradesh Eye Disease study (APEDS) [21]. The difference with respect to the sex distribution was not statistically significant in the current study (p =1).

The incidence of retinopathy and the Mean age of the patients in each group (61.45±6.99, 57.96±6.07 and 61.05±7.47 years) was correlating. Our study also showed an increased prevalence of DR with increasing age. APED Study 21, CURES Eye Study [18], Dondana et al., 3 demonstrated significant association between age and diabetic retinopathy prevelance.

In our study, the association of longer disease duration with higher risk of diabetic retinopathy (p=0.000), was also same as previously conducted studies like DCCT [22], WESDR/Klein et al. [23], UKPDS [19], Larsson et al. [24], Wong et al. [25], Varma [26], and Wisconsin Epidemiological Study of diabetic retinopathy [23]. Indian studies are also supporting the correlation [27], Gupta et al. [20]. APEDS study [21] Agarwal et al., [28]. According to CURES Eye study for every five year increase in duration of diabetes, the risk for diabetic retinopathy increased by 1.89 times [18.]

There is strong evidence that the long term glycemic control plays an important role in delaying the onset and the progression of DR [11]. In the current study, most of group 1 patients had poor glycemic control when compared to group 2. Strict glycemic control was effective in significantly reducing the incidence and progression of retinopathy complications in study of diabetes control and complication trial (DCCT) group [27]. The UKPDS study also showed that intensive glycemic control reduced the risk of two-step change in retinopathy by 21% in 12 years follow up [27,19]. In Wisconsin Epidemiological Study (WESDR) 28 and CURES eye study [18], they observed a linear trend between prevalence of diabetic retinopathy and poor glycemic control.

Current study observed statistical significant

correlation among the grades of diabetic retinopathy and total cholesterol level (p = 0.016). The mean total cholesterol and triglyceride levels were high in group 1 than group 2 and group 3. But this correlation does not shows statistically significant (p = 0.8).

According to Early Treatment Diabetic Retinopathy Study (ETDRS), patients with increased serum cholesterol levels or LDL levels at baseline were twice as likely to have diabetic retinopathy than patients with normal lipid profile [29].

Al-Bdour et al. [9] and Larsson et al. [24] observed positive correlation between diabetic retinopathy and hypercholesterolemia (p=0.04). These findings were also same with the present study.

Rema et al., studied correlation between serum lipids with diabetic retinopathy in urban south Indian population. Serum triglyceride (p= 0.001) levels and serum cholesterol levels (p= 0.014) observed high in patients with diabetic retinopathy [30], after adjusting for age. Similar results were seen in Haddad et al. [31]. In our present study, total cholesterol and TGL levels were high in group 1 as compared to group 2 and group 3, but only hypercholesterolemia shows statistically significant.

According to the Hoorn Study, incidence of diabetic retinopathy and hard exudates are related to elevated serum total and LDL cholesterol levels [27]. Agarwal et al. [28] and Sachdev et al. [33] also observed increased level of total and LDL cholesterol and reduced level of HDL/LDL cholesterol ratio in patients with diabetic retinopathy. These results are partly in correlation with our study as hypercholesterolemia but not hypertriglyceridemia was found to be a risk factor for retinopathy.

According to Klein et al., severity of diabetic retinopathy and retinal hard exudate are associated with cholesterol levels [23]. In our study, total cholesterol level is not related to the severity of DR.

Elevated triglyceride is an important risk factor for moderate and severe nonproliferative retinopathy and proliferative retinopathy even after adjustment for age, duration of diabetes, HbA1c, and proteinuria in EURODIAB study [34].

The present study shows significant correlation between hypercholesteremia and CSME, which was same with study by Al-Bdour et al. [9], and Wisconsin Epidemiological Study of Diabetic Retinopathy [23], and CURES Eye Study [18]. In a prospective analysis of ETDRS data, the development of CSME was 50% faster in patients with hypercholesterolemia and hypertriglyceridemia [29].

In our study, the severity of diabetic retinopathy not correlating with the increasing levels of serum lipid sub-fractions.

The current study did not show correlation between serum lipid levels and visual acuity as most of the cases had associated cataract. CURES eye study showed that visual acuity decreased with increase in severity of retinopathy18. As per the ETDRS study hypercholesterolemia increased the risk of visual loss by 50% [29].

The limitations of present study are that the fundus photographs and OCT were not taken.

Conclusion

The number of adults with diabetes in the world is estimated to increase by 122% (135 million in 1995 to 300% in 2025). This increase is expected to be 42% in the developed world and 170% in the developing countries. India stands first with 195% (18 million in 1995 to 54 million in 2025). The patients with retinopathy significantly shows longer mean duration of diabetes mellitus when compare to diabetics without retinopathy. The development and progression of diabetic retinopathy influenced by the level of hyperglycemia. In this study, group 1 patients (D.R) had increased total cholesterol levels and triglyceride levels. But, the severity of diabetic retinopathy not correlating with the increasing levels of serum lipid sub-fractions

References

1. Joshi SR, Parikh RM. India–diabetes capital of the world: now heading towards hypertension. J Assoc Physicians India. 2007;55:323-4.
2. Kumar A, Goel MK, Jain RB, Khanna P, Chaudhary V. India towards diabetes control: Key issues. Australas Med J. 2013;6(10):524-31.
3. Dandona R, Dandona L, Naduvilath TJ, McCarty A, Rao GN. Population based assessment of diabetic retinopathy in an urban population in southern India. Br. J. Ophthalmol. 1999;83:937-940.
4. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes-estimates for the year 2000 and projections for 2030. Diabetes Care. 2004;27(3):1047-53.
5. Anjana RM, Ali MK, Pradeepa R, Deepa M, Datta M, Unnikrishnan et al. The need for obtaining accurate nationwide estimates of diabetes prevalence in India-Rationale for a national study on diabetes.

Indian J Med Res. 2011 April;133(4):369–80.

6. Subhan SS, Rahman, Sayeed A, Hasin F, Karim R, Alif L. The Role of Duration of Diabetes in the Development of Diabetic Retinopathy in Young Diabetic patients in Bangladesh. J Bangladesh Coll Phys Surg. 2009;27:133-38.

7. Miljanovic B, Glynn RJ, David M, Nathan, Joann E, Manson, Debra A et al. Prospective Study of Serum Lipids and Risk of Diabetic Macular Edema in Type1 Diabetes. Diabetes. 2003 Nov;53:2883–2902.

8. Stephen Ryan. RETINA. 4th ed. Vol. II. Chapter 66. In: Etiologic mechanisms in Diabetic retinopathy, Robert N. Frank, eds. Philadelphia PA: Elsevier; 2006.pp.1241-65.

9. Muawyah D Al-Bdour, Maha I Al-Till, Khawla M Abu Samra. Risk factors for diabetic retinopathy among Jordanian diabetics. Middle East African Journal of Ophthalmology. 2008;15:77-80.

10. Hamilton AMP, Ulbig MW, Polkinghorne P. Management of diabetic retinopathy. BMJ Publishing group, London,1996.

11. Chowdhury TA, Hopkins D, Dodson PM, Vafidis DF. The role of serum lipids in exudative diabetic maculopathy: is there a place for lipid lowering therapy? Eye. 2002;16:689–693.

12. Reanita, Bardosono S, Victor AA. Relationship between plasma lipid profile and the severity of diabetic retinopathy in type 2 diabetes patients. Med J Indones. 2008;17:221-225.

13. DHWSu, KT Yeo. Diabetic Retinopathy and Serum Lipids. Singapore Med J. 2000;41(6):295-97.

14. Third Report of the National Cholesterol Education Program (NCEP): Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) Final Report High Blood Cholesterol in Adults. NIH Pub. No. 02--5215. Bethesda, MD: National Heart, Lung, and Blood Institute, Sept 2002;284.

15. Mohan V, Sandeep S, Deepa R, Shah B. Epidemiology of type 2 diabetes: Indian scenario. Indian J Med Res 2007 March;125:217-30.

16. Weiqin Chen, Donald B. Jump, Maria B. Grant, Walter J. Esselman, and Julia V. Busik. Dyslipidemia, but Not Hyperglycemia, Induces Inflammatory Adhesion Molecules in Human Retinal Vascular Endothelial Cells. IOVS. 2003 Nov;44(11):5016-22.

17. Rema M, Ponnaiya M, Mohan V. Prevalence of retinopathy in non insulin dependent diabetes mellitus at a diabetes centre in southern India. Diabetes Res Clin Pract. 1996;34:29-36.

18. Rema M, Srivastava BK, Anitha B, Deepa R, Mohan V. Association of serum lipids with diabetic retinopathy in urban South Indians—the Chennai Urban Rural Epidemiology Study (CURES) Eye Study—2. Diabetic Medicine 2006;23:1029–36.

19. Paromita K, Peacock I, Donnelly R. The UK Prospective Diabetes Study (UKPDS): clinical and therapeutic implications for type 2 diabetes. Br J Clin Pharmacol. 1999 November;48(5):643–648.

20. Sunil Gupta, Ajay Ambade.Prevalence of Diabetic Retinopathy and Influencing Factors amongst type 2 Diabetics from Central India. International Journal of Diabetes in Developing Countries. 2004;24:75-78.

21. Krishnaiah S, Das T, Nirmalan PK, Shamanna BR, Nutheti R, Rao GN et al. Risk factors for diabetic retinopathy: Findings from The Andhra Pradesh Eye Disease Study. Clin Ophthalmol. 2007 December;1(4):475–82.

22. Lyons TJ, Jenkins AJ, Zheng D, Lackland DT, McGee D, Garvey WT et al. and The DCCT/EDIC Research Group. Diabetic Retinopathy and Serum Lipoprotein Subclasses in the DCCT/EDIC Cohort Investigative Ophthalmology & Visual Science, March 2004;45:910-18.

23. Klein BEK, Moss SE, Klein R, Surawicz TS. The Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR), XIII: relationship between serum cholesterol to retinopathy and hard exudate. Ophthalmology. 1991;98:1261-5.

24. Lill-Inger Larsson, Albert Alm, Folke Lithner, Gosta Dahlen, Reinhold Bergstrom The association of hyperlipidemia with retinopathy in diabetic patients aged 15-50 years in the county of Umea. Acta Ophthalmol. Scand. 1999;77:585–91.

25. Wong TY, Klein R, Islam A, et al. Diabetic Retinopathy in a Multiethnic Cohort in the United States. Am J Ophthalmol. 2006;141:446–55.

26. Varma R. Diabetic retinopathy: challenges and future directions. Am J Ophthalmol. 2006;141:539–41.

27. Rema M, Pradeepa R. Diabetic Retinopathy: An Indian Perspective. Indian J Med Res. 2007;125:297-310.

28. Agarwal RP, Meeta Singla, Vyas SP, Sabir Hussain, Jain GC, Kochar DR. Prevalence of retinopathy and its relation with various risk factors in type 1 diabetes mellitus-hospital based study India. International Journal of Diabetes in Developing Countries. 2001;21:184-90.

29. Chew EY, Klein ML, Ferris FL 3rd, Remaley NA, Murphy RP, Chantry K et al. Association of elevated serum lipid levels with retinal hard exudate in diabetic retinopathy. Early Treatment Diabetic Retinopathy Study (ETDRS) Report 22. Arch Ophthalmol. 1996 Sep;114:1079-84.

30. G. Kalantzis, M. Angelou, E. Rebelakou. Diabetic

retinopathy: A historical assessment. Hormones 2006;5(1):71-74.

31. Haddad E, Ossama A W, Mohammed Kamal Saad. Prevalence and risk factors for diabetic retinopathy among Omani diabetics. Br J Ophthalmol 1998;82: 901–90.

32. VanLeiden AH, Dekker JM, Moll AC, Giel Nijpels, Heine RJ, Bouter LM et al. Blood Pressure, Lipids, and Obesity Are Associated With Retinopathy: The Hoorn Study. Diabetes Care. 2002;25:1320–32.

33. Sachdev N, Sahni A. Association of systemic risk factors with the severity of retinal hard exudates in a north Indian population with type 2 diabetes. J Postgrad Med. 2010 Sep;56:3-6.

34. Sjolie AK, Stephenson J, Aldington S, et al. Retinopathy and vision loss in insulin-dependent diabetes in Europe. The EURODIAB IDDM Complications Study. Ophthalmology. 1997 Feb; 104(2):252-60.