

## A One Year Cross Sectional Study for Evaluation of Hypertensive Retinopathy in Patients of Essential Hypertension with High Serum Lipids among Patients Attending Eye OPD, MBS Hospital, Kota

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### ABSTRACT

**Introduction:** To evaluate the role of hyperlipidemia on fundus changes in hypertensive patients and to correlate the above findings with components of lipid profile.

**Materials and Methods:** A cross-sectional study was carried out in 100 patients who were diagnosed to have essential hypertension. Normotensive patients, patients suffering from diabetes, high myopia, patients with hazy ocular media, were excluded from the study. A detailed evaluation of patients' hypertensive status was carried out by a physician after ruling out secondary causes of hypertension. Their detailed ophthalmological examination was carried out in department of Ophthalmology, GMC, Kota. All the patients were investigated for fasting serum lipid profile.

**Results:** Out of the 100 patients with essential hypertension, 64 (64%) had retinopathy and the remaining 36 (36%) subjects having no retinopathy. All patients having hypertension for more than 10 years had retinopathy. Severity of hypertension correlated well with severity of retinopathy in our study ( $p < 0.0009$ ). No sex preponderance toward developing retinopathy was found in this study ( $p < 0.19$ ). A positive correlation of hypertensive retinopathy was found with total cholesterol ( $P < 0.0001$ ), low-density lipoprotein (LDL)-cholesterol ( $P < 0.0001$ ), Serum triglycerides ( $P < 0.001$ ), and a low-density lipoprotein: high-density lipoprotein (LDL: HDL) ratio ( $P < 0.0001$ ).

**Conclusion:** This study proved a definite association between serum lipid parameters and the prevalence of hypertensive retinopathy.

**KEYWORDS:** Dyslipidemia, High-density lipoprotein, Hypertensive retinopathy, Keith Wagner Barker classification, Low-density lipoprotein.

### INTRODUCTION

Elevated blood pressure is the most important public health problem in developing and developed countries. It is common, asymptomatic, readily detectable, usually treatable, and often leads to lethal complications if left untreated.

Hypertensive retinopathy is among the vascular complications of essential hypertension. It is known that the auto regulation of the retinal circulation fails as blood pressure increases beyond a critical limit. However, elevated blood pressure alone does not fully account for the extent of retinopathy.<sup>1</sup> There are cases in which retinopathy was resolved despite the persistence of high blood pressure. In addition to the effect of high

blood pressure, other factors and humoral components probably take part in the pathogenesis of hypertensive retinopathy.<sup>2</sup>

Dyslipidemia in itself is known to be a risk factor for retinopathy and other ocular abnormalities. When it is associated with diseases like diabetes, hypertension the outcome is complicated. Its role in association with diabetic retinopathy and age related maculopathy is well proven.<sup>3,4</sup>

Dyslipidemia in hypertensive patients may act as a predisposing risk factor, an aggravating or complicating factor. An understanding of hypertensive retinopathy manifestations, spectrum of findings and their

association with components of lipid profile (LDL, HDL, Total Cholesterol, and Triglycerides) may be helpful in risk stratification and in tailoring of anti-hypertensive and lipid lowering treatment.

Hence present study was carried out to assess the association between concentrations of various serum lipids, lipoproteins and retinal changes, in patients with essential hypertension.

**MATERIALS AND METHODS**

This was a hospital based, cross-sectional, descriptive study, where intervention was done as per requirement. This study was carried out in department of Ophthalmology, GMC, Kota from December 2014 to November 2015.

A cross-sectional study was performed on 100 patients who were diagnosed to have essential hypertension at Department of Ophthalmology, GMC, Kota. Normotensive patients, patients suffering from diabetes, high myopia and patients with hazy ocular media in both eyes were excluded from the study. A detailed ophthalmological examination included best corrected visual acuity, anterior segment examination using slit lamp and posterior segment examination by direct ophthalmoscopy, slit lamp biomicroscopy using 90D, and indirect ophthalmoscopy. Staging of hypertensive

retinopathy was carried out using Modified Keith Wagner Barker Classification.<sup>5, 6</sup> Patients were investigated for complete fasting serum lipid profile. After complete evaluation, patients were counseled and appropriate treatment reference was advised.

For different groups and parameters, mean & standard deviation were calculated. Means of the relative groups were compared using students unpaired ‘t’ tests. Data analysis was done by SPSS version 16 & GraphPad Prism 6. *P* <0.05 was considered significant. Appropriate standard test were used for different tables.

**RESULTS**

After satisfying the selection criteria, 100 patients were included in this study. Out of 100 patients, 36 patients had a normal fundus and 64 patients had retinopathy in both eyes. Each patient had retinopathy in both eyes of the same grade. The mean age, duration of hypertension, systolic BP, diastolic BP, total cholesterol, low-density lipoprotein (LDL)-cholesterol, serum triglycerides, and the low-density lipoprotein: high density lipoprotein (LDL:HDL) ratio were high compared with those who did not show any signs of retinopathy and the association was statistically significant. Only the mean fasting blood sugar level and serum HDL level associations were not statistically significant.

**Table 1: Showing Relationship of Hypertensive Retinopathy with Serum Total Cholesterol**

Grade of Hypertensive Retinopathy	Serum total Cholesterol level (mg/dl) <sup>7</sup>			Total Patients	Mean total cholesterol (mg/dl)
	<200 (mg/dl)	200-239 (mg/dl)	>240 (mg/dl)		
Normal	36	0	0	36	160.3±22.05
I	15	02	0	17	181.5±19.64
II	20	11	04	35	200.5±33.45
III	04	03	05	12	237.8±48.77
IV	00	00	00	00	-
<b>Total patients</b>	<b>75</b>	<b>16</b>	<b>09</b>	<b>100</b>	

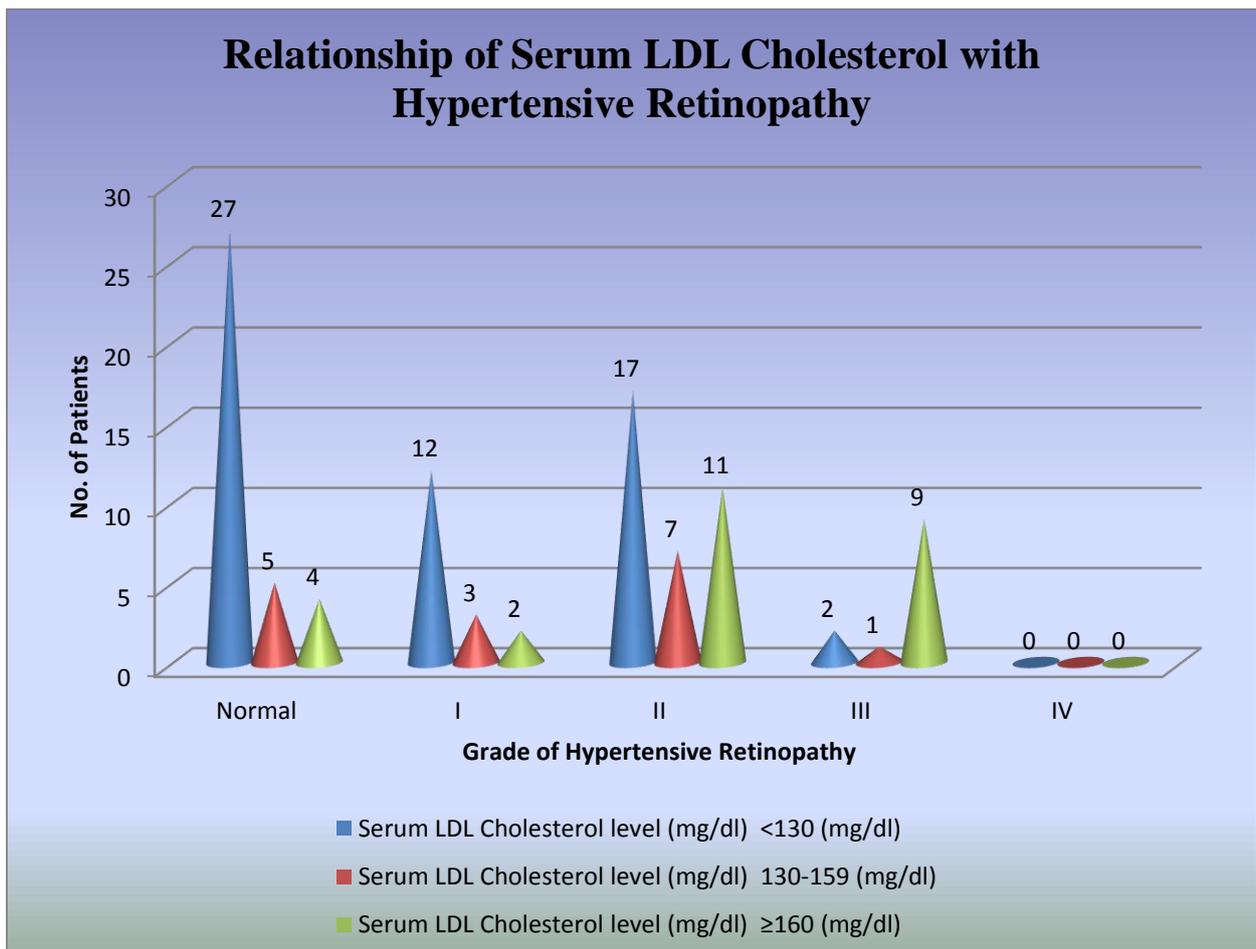
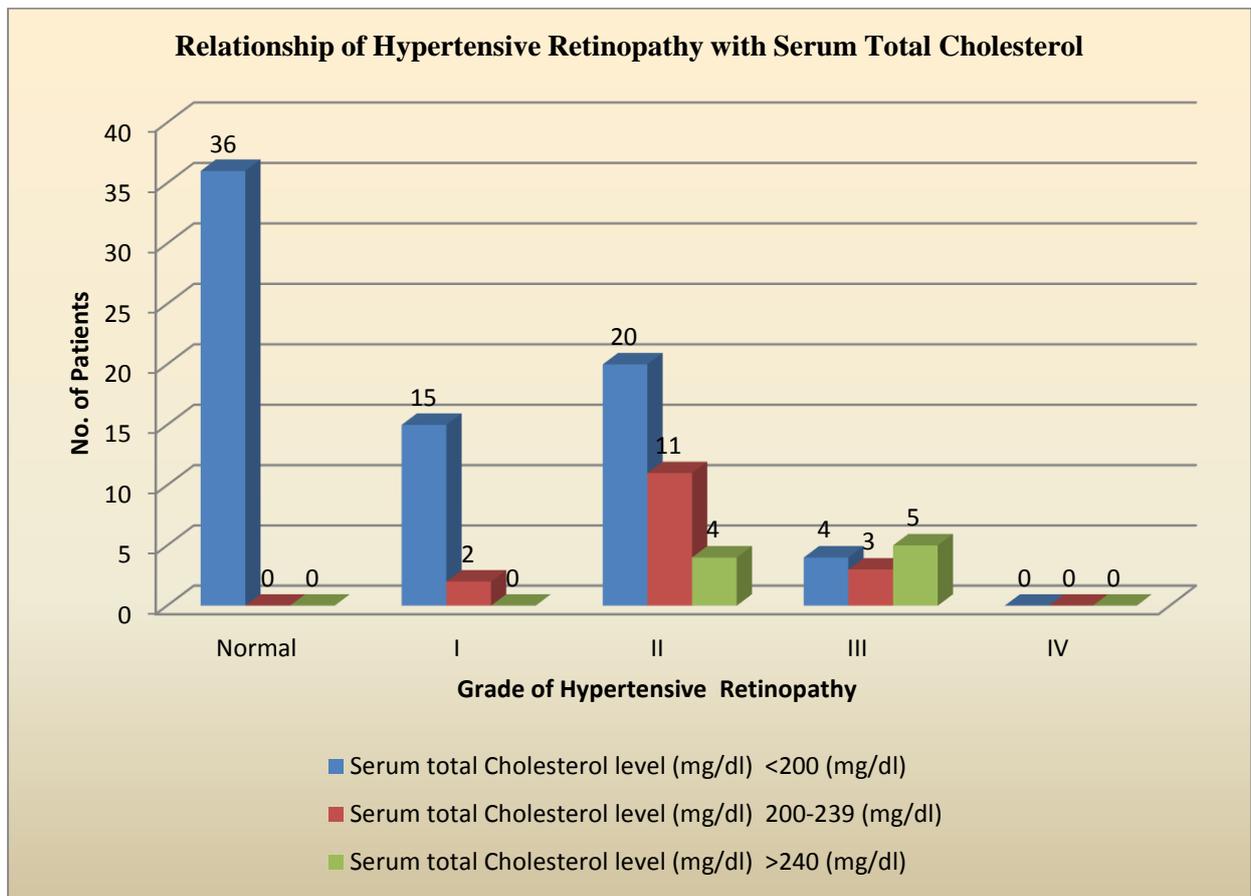
*P*<0.0001

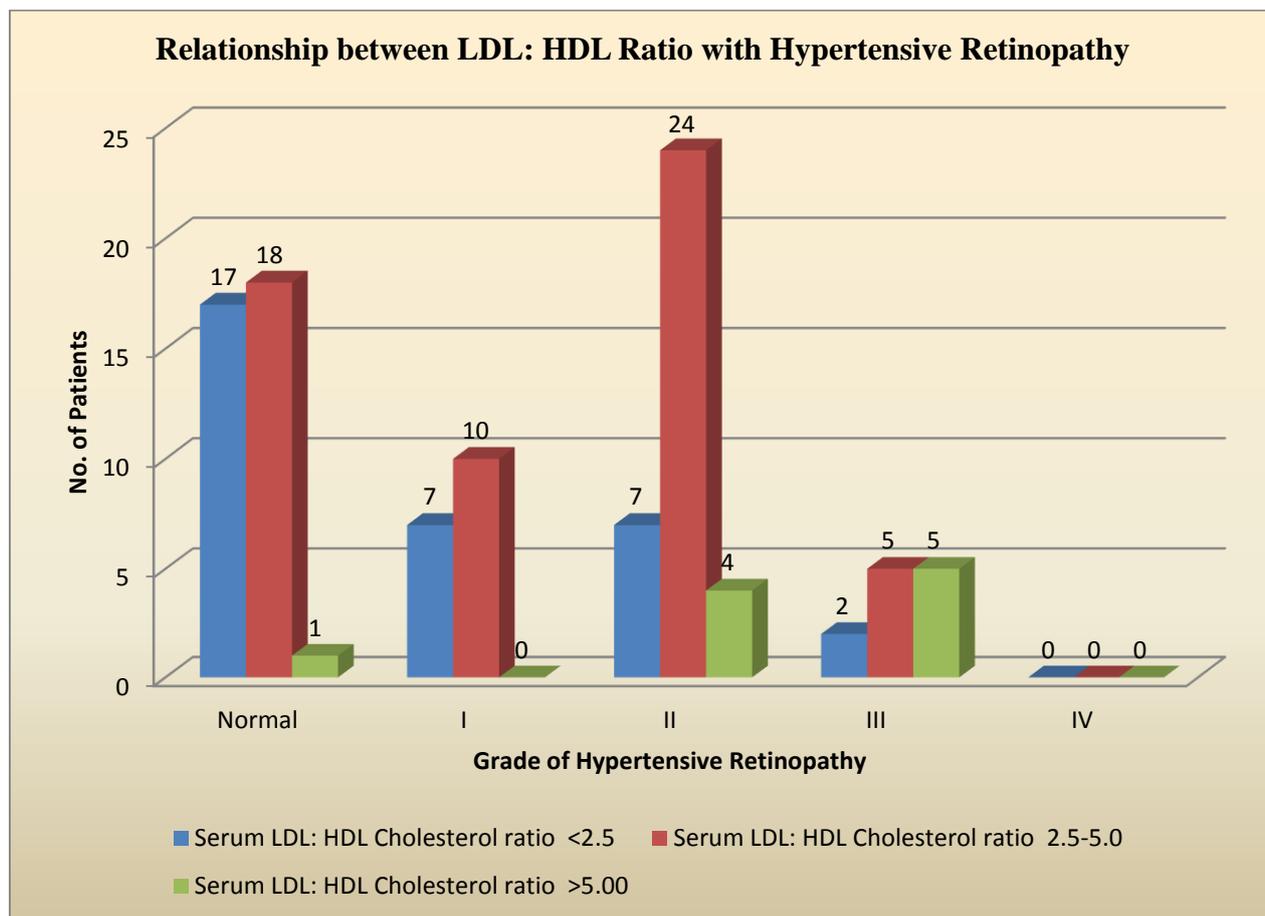
**Table No. 2: Showing Relationship of Serum LDL Cholesterol with Hypertensive Retinopathy**

Grade of Hypertensive Retinopathy	Serum LDL Cholesterol level (mg/dl) <sup>7</sup>			Total Patients	Mean LDL cholesterol (mg/dl)
	<130 (mg/dl)	130-159 (mg/dl)	≥160 (mg/dl)		
Normal	27	05	04	36	112.3±34.40
I	12	03	02	17	114.2±34.65
II	17	07	11	35	137.4±48.84
III	02	01	09	12	180.2±43.79
IV	00	00	00	00	-
<b>Total patients</b>	<b>58</b>	<b>16</b>	<b>26</b>	<b>100</b>	

**Table 3: Showing Relationship between LDL and HDL Ratio with Retinopathy**

Grade of Hypertensive Retinopathy	Serum LDL: HDL Cholesterol ratio <sup>7</sup>			Total Patients	Mean Ratio
	<2.5	2.5-5.0	>5.00		
Normal	17	18	01	36	2.71±1.05
I	07	10	0	17	2.60±0.78
II	07	24	04	35	3.51±1.52
III	02	05	05	12	4.74±1.69
IV	00	00	00	00	-
<b>Total patients</b>	<b>33</b>	<b>57</b>	<b>10</b>	<b>100</b>	





**Table 4: Showing Relationship between Serum HDL-Cholesterol with Hypertensive Retinopathy**

Grade of Hypertensive Retinopathy	Serum HDL-Cholesterol level (mg/dl) <sup>7</sup>			Total patients	Mean HDL cholesterol (mg/dl)
	>60 (Desirable)	36-60 (Borderline)	<35 (Abnormal)		
Normal	05	21	10	36	43.61±13.05
I	02	12	03	17	45.76±12.34
II	03	18	14	35	41.66±12.39
III	01	07	04	12	41.42±12.59
IV	00	00	00	00	-
<b>Total patients</b>	<b>11</b>	<b>58</b>	<b>31</b>	<b>100</b>	

**Table 5: Showing Relationship of Serum Triglycerides with Hypertensive Retinopathy**

Grade of Hypertensive Retinopathy	Serum Triglycerides level (mg/dl) <sup>7</sup>		Total Patients	Mean (mg/dl)
	<150 (mg/dl)	>150 (mg/dl)		
Normal	29	07	36	116.1±29.45
I	04	13	17	203.1±64.71
II	07	28	35	215.5±71.82
III	01	11	12	210.0±53.38
IV	00	00	00	-
<b>Total patients</b>	<b>41</b>	<b>59</b>	<b>100</b>	

P<0.0001

Among 100 patients studied, 21 (21%) patients belong to 40-50 years age category. Of these 08 (38.09%) had retinopathy whereas 13 (61.90%) had no retinopathy. The next category consisting of 33 (33%) patients belong to (51-60) years of age group. 16(48.49%) showed retinopathy, while 17 (51.51%) showed no retinopathy. Another category consisting of 37 (37%)

patients belonging to 61-70 years of age group. 31 (83.78%) patients had retinopathy, while 06 (16.22%) patients, had no retinopathy. In the last category i.e. above 71 years had 09 (09%) patients, of which all 09 (100%) patients had retinopathy. Out of these 64 patients belong to retinopathy group with mean age of 63.84±9.01 years and 36 patients had normal fundus,

with mean age of  $54.56 \pm 6.89$  years ( $p < 0.0001$ ). We also found that retinopathy increased significantly above 50 years of age.

There were 58 females and 42 males in our study group, out of which 39 (67.24%) females and 25 (59.52%) males had retinopathy. 19 (32.76%) females and 17 (40.48%) males had no signs of retinopathy respectively. Of 100 patients, 61 (61%) patients had hypertension since 0-5 years. Of which 25 (40.98%) had retinopathy of varying degrees, while 36 (59.01%) had no retinopathy. There were 31 (31%) patients who had hypertension since 6-10 years, of which all 31 (100%) patients had retinopathy. Next group of 04 (4%) patients, had hypertension since 11-15 years, of which 4 (100%) patients had retinopathy. Among the last group of 4 (4%) patients who had hypertension since > 15 years, 4 (100%) had retinopathy. Overall, the relationship between various grades of retinopathy and duration was statistically significant ( $p < 0.0014$ ).

Out of 100 patients, 75 (75%) had total serum cholesterol within normal limits ( $< 200$  mg/dl), of which 39 (52%) patients had retinopathy. The next group of 16 (16%) patients had total serum cholesterol between (200-239 mg/dl) which is considered to be borderline. Of which all 16 (100%) patients had retinopathy. The last group of 09 (9%) patients had serum total cholesterol levels of  $> 240$  which is considered to be abnormal. Of which 9 (100%) patients had retinopathy.

Overall the increase in total serum cholesterol levels correlated well with increasing severity of retinopathy ( $p < 0.0001$ ). [Table: 1]

Out of 100 patients studied, 58 (58%) had serum LDL-Cholesterol levels of  $< 130$  mg/dl (normal). Of which 31 (53.45%) had retinopathy of varying grades. The next group of 16 (16%) had serum LDL-Cholesterol levels between (130-159) mg/dl (borderline) of which 11 (68.75%) had retinopathy. The last group of 26 (26%) patients had serum LDL-Cholesterol levels of  $\geq 160$  mg/dl (abnormal) of which 22 (84.62%) had retinopathy. Overall, the increasing level of serum LDL-cholesterol showed statistically significant correlation with the grades of hypertensive retinopathy ( $P < 0.0001$ ) [Table 2]. Out of 100 patients; 33 (33%) patients had LDL: HDL ratio of  $< 2.5$ , of which 16 (48.48%) had varying grades of retinopathy. The next group of 57 (57%) patients had serum LDL: HDL ratio 2.5-5.0 of which 39 (68.42%) had retinopathy. The last group of 10 (10%) patients had serum LDL: HDL ratio  $> 5.00$ . Of which 9 (90%) patients had retinopathy.

Overall, the increasing levels of LDL: HDL-cholesterol correlated positively with increasing severity of retinopathies, which was statistically significant ( $P < 0.0001$ ) [Table 3]. Overall there was no statistically significant relation between the serum levels of HDL-Cholesterol and the grades of retinopathy ( $p < 0.68$ ). [Table: 4]

Out of 100 patients, 41 (41%) patients had serum triglycerides levels of  $< 150$ , of which 12 (29.27%) patients had retinopathy whereas of the remaining 59 (59%) patients who had serum triglycerides levels of  $> 150$  mg/dl 52 (88.14%) patients had retinopathy.

Overall, serum triglyceride levels correlated positively with the increasing severity of retinopathy, which was statistically significant ( $P < 0.0001$ ) [Table 5].

## DISCUSSION

The mean age of patients in present study population was  $60.50 \pm 9.41$  years ranging from 44-87 years. Out of these 64 patients belong to retinopathy group with mean age of  $63.84 \pm 9.01$  years and 36 patients had normal fundus, with mean age of  $54.56 \pm 6.89$  years ( $p < 0.0001$ ). In a study carried out by Bastola et al.<sup>8</sup> the mean age of the study group was 58.5 years (SD = 9.2 years; range = 33-48).

There were 58 females and 42 males in our study group, out of which 39 (67.24%) females and 25 (59.52%) males had retinopathy. 19 (32.76%) females and 17 (40.48%) males had no signs of retinopathy respectively, there was no significant sex preponderance ( $p < 0.19$ ). In the past, there have been fewer studies of the incidence of hypertensive retinopathy and none of them have shown sex preponderance.

In present study, there was an increased incidence of hypertensive retinopathy in patients having high serum total cholesterol level and this association was statistically significant ( $P < 0.0001$ ).

Similarly, Bastola et al.<sup>8</sup> in their study, also showed that there was a statistically significant difference in the mean serum cholesterol level ( $F = 10.38$ ;  $P < 0.001$ ) of patients with normal fundus and in those with different grades of hypertensive retinopathy. In recent study, Gupta R P et al.<sup>9</sup> also showed that there was an increased incidence of hypertensive retinopathy in patients having high serum cholesterol level and this association was statistically significant ( $P < 0.0008$ ).

In present study we also found a significant association between high serum LDL-Cholesterol and the severity of the retinopathy, ( $p < 0.0001$ ). Badhu et al.<sup>10</sup> and Bastola et al.<sup>8</sup> also showed a significant correlation between high serum LDL-cholesterol and hypertensive retinopathy.

In our study the mean serum HDL-Cholesterol values for retinopathy group were 42.70 & that for no retinopathy group was 43.61. There was no significant association of the serum HDL-Cholesterol & the retinopathy. Bastola et al.<sup>8</sup> & Gupta RP et al.<sup>9</sup> also showed similar findings. No other study has reported any correlation between serum HDL-cholesterol and hypertensive retinopathy so far.

In present study the association of LDL: HDL-Cholesterol ratio was found to be statistically significant ( $p < 0.0001$ ). Gupta R P et al.<sup>9</sup> show in their study that association of LDL: HDL-Cholesterol ratio was found to be statistically significant ( $P < 0.0001$ ).

In our study overall association of serum triglycerides was found significant with retinopathy ( $p < 0.0001$ ). Gupta R P et al<sup>9</sup> found a significant association between serum triglycerides and hypertensive retinopathy patients ( $P < 0.01$ ). Mean triglycerides levels were also found to be high in grade II and higher hypertensive retinopathy patients in a study carried out by Bastola et al<sup>8</sup>. Thus, this study shows a definite association between serum lipid parameters and the prevalence of hypertensive retinopathy.

## CONCLUSION

Hypertensive retinopathy has been found to occur in people above 40 years of age, with a mean age of 60 years. There was no sex preponderance. There was an increase in incidence of hypertensive retinopathy with increase of serum total cholesterol, serum LDL, and serum triglycerides. However, no correlation was found between HDL-cholesterol and hypertensive retinopathy. Dyslipidemia can be considered as important risk factors. For not only the prevalence and severity of retinopathy but also for other end organ failures. Preservation of vision may be an additional motivating factor for lowering serum lipid levels in persons with hypertension in whom they are elevated.

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