ORIGINAL RESEARCH PAPER

Ophthalomology

KEY WORDS: dyslipidemia, high density lipoprotein, hypertensive retinopathy, keith wagener barker classification, low density lipoprotein.

STUDY OF ASSOCIATION BETWEEN HYPERTENSIVE RETINOPATHY AND VARIOUS LIPID PARAMATERS IN PATIENTS OF ESSENTIAL HYPERTENSION VISITING TERTIARY EYE HOSPITAL IN SOUTHERN INDIA

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ABSTRACT

Aim: To study the association of components of lipid profile with hypertensive retinopathy in patients of essential hypertension. Materials and Methods: A Cross Sectional Study was carried out in 80 patients who were diagnosed to have systemic Hypertension. Patients having myopia, having diabetes, hazy ocular media, and other retinal problems were excluded from the study. A detailed examination of patient's hypertensive status was done by physician after ruling out secondary causes of hypertension. Full ophthalmological examination was carried out. All the patients were investigated for fasting serum lipid profile. Results: Out of the 80 patients with essential hypertension, 55 (55%) had retinopathy and the remaining 25 (25%) subjects had no retinopathy were mainly concentrated in the 6th decade (69.70%), increasing thereafter up to 83.78% who were over 60 years of age. This shows the increasing prevalence of hypertensive retinopathy with increasing age. No sex preponderance toward developing retinopathy was found in this study . A positive correlation of hypertensive retinopathy was found with total cholesterol ($P < 0.002$), low-density lipoprotein (LDL)-cholesterol ($P < 0.0001$), Serum triglycerides ($P < 0.01$), and an low-density lipoprotein: high-density lipoprotein (LDL:HDL) ratio ($P < 0.002$). **Conclusion:** The duration of hypertension was found to be strongly associated with development of hypertensive retinopathy. This study proved a definite association between serum lipid parameters and prevalence of hypertensive retinopathy.

INTRODUCTION

Hypertension is the emerging public health problem in both developing and developed countries. It is common, asymptomatic, readily detectable, usually treatable, and often leads to lethal complications if left untreated.

According to WHO over 17 million deaths occur globally because of cardiovascular disease in a year, of which more than 50 percent deaths occur because of complications of hypertension.[1]

Hypertensive retinopathy is among the vascular complications of essential hypertension. It is known that the autoregulation 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. In addition to this other factors and humoral components probably take part in the pathogenesis of hypertensive retinopathy.

Dyslipidemia in hypertensive patients is itself known to be a predisposing risk factor, an aggravating or complicating factor.[2] Hypertension and hyperlipidemia not only accelerate atherogenesis but also cause degenerative changes in the walls of large- and medium-sized arteries,[3] which accelerate cerebrovascular haemorrhage,[4] ischemic heart disease,[5] stroke, and cardiac arrest.[6]

Hence, this study helps to assess the association between hypertensive retinopathy in patients of essential hypertension with an altered serum total cholesterol (TC), serum triglycerides (TG), serum low density lipoprotein (LDL and serum high density lipoprotein (HDL) , with the aim of preserving vision by tailoring a lipid-lowering treatment.

MATERIALS AND METHODS

A hospital based, descriptive cross- sectional study was carried out in 80 patients attending the Ophthalmology department of Sree Balaji Medical college and Hospital, Chrompet, Chennai who were diagnosed to have essential hypertension from march 2020 to September 2020.

Patients suffering from diabetes, high myopia, patients with hazy ocular media in both eyes, and other retinal vascular disorders 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 slit lamp biomicroscopy using 90D, and indirect ophthalmoscopy followed by fundus photography.

Staging of hypertensive retinopathy was carried out using Modified Keith Wagner Barker Classification.[9] Patients were investigated for complete fasting serum lipid profile. After complete evaluation, patients were counseled and appropriate treatment reference was advised.

The association between hypertensive retinopathy and serum lipid profile parameters were assessed using chi – square test.

RESULTS

After satisfying the selection criteria, 80 patients were included in this study. Out of 80 patients, 25 patients had a normal fundus and 55 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 trigylcerides, 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.

Table 1 - Gender distribution of HR

Gender	HR (-) Frequency (%)	HR (+) Frequency (%)	Total Frequency (%)
Male	14(26.56)	37(73.44)	51(63.7)

Female	11(38.89)	18(61.11)	29(36.2)
Total	25(31.2)	55(68.75)	80(100.0)

There were 51 males and 29 females in our study group. Out of these, 37 (73.44%) males and 18 (61.11%) females had retinopathy, and 14 (26.56%) males and 11 (38.89%) females had no retinopathy

Table 2 - Age distribution of HR

Age group (years)	HR(-) Frequency(%)	HR(+) Frequency(%)	Total Frequency(%)
31-40	4	3	7
	(54.45)	(45.45)	(9.0)
41-50	8	9	17
	(47.37)	(52.63)	(21.0)
51-	8	18	26
	(30.3)	(69.70)	(33.0)
60 >60	5	25	30
	(16.7)	(83.3)	(37.0)

Among the 80 patients studied, 7 patients belong to the 31-40-year age group. Of these 03 (45.45%) had retinopathy whereas 04 (54.55%) did not. The next category consisting of 17 patients belong to the 41-50-year age group, of which 9 (52.63%) had retinopathy, whereas 08 (47.37%) showed no retinopathy. Another category consisted of 26 patients belonging to the 51-60-year age group, out of which 18 (69.70%) patients had retinopathy, whereas 8(30.30%) patients had no retinopathy. In the last category, i.e. age above 60 years, there were 30 patients, of which 25 (83.3%) had retinopathy and 05 (16.7%) had no retinopathy. In our study, we found that hypertensive retinopathy increases significantly with increase in age as the Chi square value is equal to 9.073 with a 3 degree of freedom (P = 0.036). We also found that retinopathy increased significantly above 50 years of age.

Table 3 Duration of hypertension and retinopathy

Duration (years)	HR(-) Frequency(%)	HR(+) Frequency(%)	Total Frequency(%)
<5	23	15	38
	(61.7)	(38.3)	(47.5)
5-10	2	20	22
	(7.14)	(92.86)	(28)
11-15	0	14	14
	(0.0)	(100)	(18)
>15	0	6	6
	(0.0)	(100.0)	(8)
Total	25	55	80
	(31.3)	(68.8)	(100.0)

Of the 80 patients, 38 patients had hypertension since 0-5 years. Of these, 15 (38.3%) had retinopathy of varying degrees, whereas 23 (61.7%) had no retinopathy. There were 22 patients who had hypertension for duration of 6-10 years of which 20 (92.86%) patients had retinopathy, whereas 02 (7.14%) patients had no retinopathy. The next group of 14 patients had hypertension for duration of 11-15 years, and all these patients had retinopathy. Among the last group of 6 patients who had hypertension since >15 years, all had retinopathy. Overall, the relationship between various grades of retinopathy and duration was statistically significant (P < 0.0001).

Table 4 Relationship of grades of retinopathy with serum total cholesterol

TC					
HR	<200mgdl Frequency (%)	200-239mg/dl Frequency (%)	≥240mg/dl Frequency (%)	Total Frequency (%)	p-value
No retinopathy	20	5	1	26	0.0001
	(78.3)	(19.6)	(2.2)	(34.1)	
Grade I	10	4	2	16	
	(64.5)	(25.8)	(9.7)	(23)	
Grade II	11	4	7	22	
	(52.5)	(17.5)	(30.0)	(29.6)	
Grade III	5	3	8	16	
	(29.4)	(17.6)	(52.9)	(12.6)	
Grade IV	0	0	0	0	
	(0.0)	(0.0)	(0.0)	(0.7)	
Total	46	16	18	80	
	(60.7)	(20.0)	(19.3)	(100.0)	

Out of the 80 patients, 46 had total serum cholesterol within normal limits (<200 mg/dl). Of these, 26 (34.1%) patients had retinopathy, whereas 20 (78.3%) patients had no retinopathy. The next group of 16 patients had total serum cholesterol between 200 and 239 mg/dl, which is considered to be borderline. Of these, 11 patients had retinopathy, whereas 5 patients had no retinopathy. The last group of 18 patients had serum total cholesterol levels of >240, which is considered to be abnormal. Of these, 17 patients had retinopathy. Overall, the increase in total serum cholesterol levels correlated well with the increasing severity of retinopathy (P < 0.0008)

Table 5 Relationship of serum LDL cholesterol with grades of retinopathy

LDL					
HR	<130mg/dl Frequency (%)	130-159mg/dl Frequency (%)	≥160mg/dl Frequency (%)	Total Frequency(%)	p-value
No retinopathy	23	3	0	26	0.0001
	(89.1)	(10.9)	(0.0)	(34.1)	
Grade I	10	5	1	16	
	(61.3)	(29.0)	(9.7)	(23)	
Grade II	14	2	6	22	
	(62.5)	(10.0)	(27.5)	(29.6)	
Grade III	5	2	9	16	
	(29.4)	(11.8)	(58.8)	(12.6)	
Grade IV	0	0	0	0	
	(0.0)	(0.0)	(100.0)	(0.7)	
Total	52	12	16	80	
	(66.7)	(14.8)	(18.5)	(100.0)	

Out of the 80 patients studied, 52 (66.7%) had serum LDL-cholesterol levels of <130 mg/dl (normal). of these, 23 (89.1%) had no retinopathy, whereas 29 had retinopathy of varying grades. the next group of 12 (14.8%) had serum LDL cholesterol levels between 130 and 159 mg/dl (borderline), of which 03 (10.9%) had no retinopathy, whereas 9 had retinopathy. the last group of 16 (18.5%) patients had serum LDL-cholesterol levels of >160 mg/dl (abnormal), of which 0 (0.0%) patients had no retinopathy, whereas 16 had retinopathy. Overall, the increasing level of serum LDL-cholesterol showed statistically significant correlation with the grades of hypertensive retinopathy (P < 0.0001)

Table 6 Relationship of serum HDL cholesterol with grades of retinopathy

HDL					
HR	35mg/dl Frequency(%)	36-60mgdl Frequency (%)	>60mg/dl Frequency(%)	Total Frequency(%)	p-value
No retino	19	6	1	26	0.898
	(71.7)	(21.7)	(6.5)	(34.1)	
Grade I	10	5	1	(23)16	
	(61.3)	(29.0)	(9.7)		

Grade II	13	6	3	22
	(60.0)	(27.5)	(12.5)	(29.6)
Grade III	9	6	1	16
	(58.8)	(35.3)	(5.9)	(12.6)
Grade IV	0	0	0	0
	(0.0)	(0.0)	(0.0)	(0.7)
Total	51	23	6	80
	(64.4)	(26.7)	(8.9)	(100.0)

Out of the 80 patients, 6 patients had serum HDL- cholesterol levels of >60 mg/dl of which 1 patient had no retinopathy and 5 patients had retinopathy. the next group of 23 patients had serum HDL-cholesterol levels in the range 36-60 mg/dl (borderline), of which 17 patients had retinopathy and 6 had no retinopathy. the last group of 51 patients had serum HDL-C levels of <35 mg/dl (abnormal), of which 32 patients had retinopathy, whereas 19 did not.

Table 7 - Relationship of HDL:LDL ratio with grades of retinopathy

HDL:LDL					
HR	<2.5 Frequency (%)	2.5-5 Frequency (%)	>5 Frequency (%)	Total Frequency	p-value
No retinopathy	18	8	0	26 (34.1)	0.001
	(69.6)	(30.4)	(0.0)		
Grade I	8	7	1	16	
	(51.6)	(41.9)	(6.5)	(23)	
Grade II	11	7	4	22	
	(50.0)	(30.0)	(20.0)	(29.6)	
Grade III	9	6	1	16	
	(58.8)	(35.3)	(5.9)	(12.6)	
Grade IV	0	0	0	0	
	(100.0)	(0.0)	(0.0)	(0.7)	
Total	46	28	6	80	
				(100.0)	

Out of the 80 patients, 46 patients had an LDL:HDL ratio of <2.5, of which 28 had varying grades of retinopathy, whereas 18 had no retinopathy. The next group of 28 patients had a serum LDL:HDL ratio of between 2.5 and 5.1. Of these, 20 had retinopathy, whereas 8 had no retinopathy. The last group of 6 patients had a serum LDL HDL-C ratio >5.00. Of these, 6 patients had retinopathy. Overall, the increasing levels of LDL:HDL-cholesterol correlated positively with increasing severity of retinopathies, which was statistically significant .

Table 8 Relationship of triglyceride with grades of retinopathy

HR	Triglyceride		Total Freqency(%)	p-value
	<150mg/dl Frequency(%)	≥150mg/dlFrequency(%)		
No retinopathy	23 (87.0)	3 (23.0)	26 (34.1)	0.0001
Grade I	8 (48.4)	8 (51.6)	16 (23)	
Grade II	7 (32.5)	15 (67.5)	22 (29.6)	
Grade III	4 (23.5)	12 (76.5)	16 (12.6)	
Grade IV	0 (0.0)	0 (100)	0 (0.7)	
Total	42	38	80 (100.0)	

Out of the 80 patients, 42 patients had serum triglyceride levels of <150 (normal), of which 29 patients had retinopathy, whereas 23 patients had no retinopathy. Of the remaining 38 patients who had serum triglyceride levels of >150 mg/dl, 35 patients had retinopathy, whereas 03 patients did not. Overall, serum triglyceride levels correlated positively with the increasing severity of retinopathy, which was statistically significant

DISCUSSION

The mean age of patients in the present study population was 56.50 ± 21.00 years, ranging from 35 to 78 years. Out of these, 55 patients belonged to the retinopathy group with a mean age of 56.00 ± 17.00 years and 25 patients had normal fundus, with a mean age of 50.50 ± 150 years ($P < 0.001$). In a study carried out by Bastola et al.,[11] the mean age of the study group was 58.5 years . There were 50.4% male among them 67.6% had HR and 49.6% female among them 64.2% had HR. There was no statistically significant gender preponderance ($p=0.672$). None of the past studies showed gender preponderance, though there were limited studies on incidence of HR.

In our study, there was an increased incidence of hypertensive retinopathy in patients having high serum cholesterol level and this association was statistically significant ($P < 0.0008$). Similarly, Bastola et al.,[11] 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 this present study, there was an increase prevalence of retinopathy in hypertensive patients whaving high serum LDL level and this association was highly statistically significant ($P<0.0001$).The studies conducted by Bastola et al[9] and Badhu et al[12] also showed a statistically significant association between high serum LDL- cholesterol and HR. Bastola et al.[11] also showed a significant correlation between serum LDL-cholesterol and grade II and higher hypertensive retinopathy ($F = 30.39$; $P < 0.001$). There was no significant association between serum HDL- cholesterol and retinopathy. Bastola et al.[11] also showed similar findings. No other study has reported any correlation between serum HDL-cholesterol and hypertensive retinopathy so far. The association of LDL:HDL-cholesterol ratio was found to be statistically significant ($P < 0.0001$).

We found a significant association between serum triglycerides and hypertensive retinopathy patients ($P < 0.01$). . Similarly, in the study conducted by Bastola et al, the mean serum TG level were also found to be high in grade II and higher grades of HR.

Hence, our study shows a definite association between increased serum lipid parameters and prevalence of HR.

CONCLUSION

Hypertensive retinopathy has been found to occur in people above 35 years of age, with a mean age of 56 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

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