Original Research Article

Study to Relate Hypertensive Retinopathy with Serum Lipid and CRP Levels

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Abstract

Background: Hypertension is one of the common cardiovascular diseases causing mortality because of its complications. Hence early detection and treatment of hypertension and its risk factor can reduce the mortality rate.
Objectives: To correlates hypertensive retinopathy with lipid levels and C Reactive Protein (CRP) in hypertension.
Materials and Methods: The study was done over a period of 18 months and 100 patients were included in the study who attended outpatient clinical services of a tertiary teaching Hospital in South India fulfilling the inclusion and exclusion criteria. Patients attending OPD for regular follow up of hypertension were screened for hypertensive retinopathy. The grading of hypertensive retinopathy was done using Keith – Wagener and Barker (KWB) classification. An informed consent was obtained from patients with hypertensive retinopathy (HR) fulfilling inclusion and exclusion criteria for the study. Lipid profile and serum CRP was done in every patient included in the study.
Results: The study was done to relate hypertensive retinopathy with serum lipid and CRP levels. The age distribution was 40 to 87 years. Females contributed majority of study population. Majority of patients were of grade 1 hypertensive retinopathy. None of them had grade 3 and 4 hypertensive retinopathy. There was no significant increase in total cholesterol, triglycerides and Low density lipoprotein (LDL) with grades of hypertensive retinopathy. No significant association of High density lipoprotein (HDL) and Very low density lipoprotein (VLDL) with hypertensive retinopathy was found. There was statistically significant relationship between hypertensive retinopathy and CRP.
Conclusion: The present study is to relate hypertensive retinopathy with serum lipid and CRP levels. There was statistically significant association between hypertensive retinopathy and CRP. But there was no significant relationship between hypertensive retinopathy and serum lipids.
Keywords: Hypertensive retinopathy; Serum Lipids; CRP.

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1. Introduction

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] Though the complications of hypertension are well known, hypertension remains inadequately detected and treated because of its asymptomatic nature. Hence early detection and treatment of hypertension and its risk factors can reduce the mortality rate.

In patients with hypertension a spectrum of vascular changes can be seen in the vasculature of retina; these changes are called hypertensive retinopathy (HR). The eighth report of the Joint National Committee (JNC 8) for hypertension recommends evaluation of HR as a part of standard care of hypertension and lists HR as a marker of target organ damage.[2] As HR can be easily detected by direct ophthalmoscopy, it can be used to determine the severity of hypertension.

Abnormalities in serum lipid levels (dyslipidaemia) are major modifiable risk factor for hypertension.[3] The sedentary life style, increased consumption of saturated fats, stressful life has increased the incidence of dyslipidaemia.

Inflammatory process contributes to the pathophysiology of cardiovascular disease; C reactive protein (CRP) being an inflammatory marker is increased in the blood of patients with hypertension and hence predicts the development of cardiovascular disease.[4]

In review of literature not much data was available from south India on lipid pattern and CRP in hypertensive retinopathy. Hence we intended to relate hypertensive retinopathy to Lipid profile and CRP levels.

1.1 Aims & objective:

To correlate hypertensive retinopathy with lipid levels and CRP and in hypertension.

2. Materials and methods

2.1 Source of data:

Patients attending outpatient clinical services of a tertiary teaching Hospital in South India fulfilling the inclusion and exclusion criteria were included in the study.

2.2 Study Type: Descriptive study.

The study was done over a period of 18 months after obtaining institutional ethical clearance and 100 patients were included in the study.

Patients attending OPD for regular follow up of hypertension were screened for hypertensive retinopathy using a direct ophthalmoscope (Heine 3000). The grading of hypertensive retinopathy was done using Keith – Wagener and Barker (KWB) classification. Findings were confirmed with ophthalmologist. An informed consent was obtained from patients with HR fulfilling inclusion and exclusion criteria for the study. Further, a detailed clinical history and examination including the weight, height, Body mass index (BMI) and waist circumference was performed. Lipid profile and serum CRP was done in every patient included in the study.

2.3 Selection criteria:

Inclusion criteria:

  (i) Age > 18 years
  (ii) Hypertensive patients with Hypertensive Retinopathy.

Exclusion criteria:

  (i) Patients with history of Inflammatory bowel disease, Acute febrile illness, Rheumatoid arthritis, Diabetes mellitus, connective tissue disorder.
  (ii) Patients with cataract/ ocular injury/ ocular surgery/ laser photocoagulation.

2.4 Analysis:

Collected data was analysed by percentages, frequency, mean, standard deviation, Chi - square test and Karl - Pearson correlation coefficient.

3. Results

The mean age of patients in this study group was 61.06 years. Age distribution was between 40 to 87 years. Among 100 patients who were studied 55% were females and 45% were males. The ratio of females to males was

1.2:1. Among 100 patients 84% were having Grade 1 hypertensive retinopathy (HR) and remaining were grade 2 (16%). None of them had grade 3 or 4 hypertensive retinopathy. Among 100 patients 64% had increased waist circumference and remaining 36% had normal waist circumference. Increased waist circumference was found in 59.5% and 87.5% among grade 1 and 2 HR respectively. BMI was high among 68% of patients and remaining 32 % had normal BMI. Total cholesterol was normal among 51% of patients. High cholesterol was found in 49% of patients. Among grade 2 HR patients, 68.8% had increased cholesterol, while only 45.2 % had increased total cholesterol in grade1 HR. Normal triglycerides were found in 61% of subjects and remaining 39% had high triglycerides. LDL was high among 88% of patients and remaining 12 % had normal LDL. Among grade 1 HR 86.9% had high LDL, while grade 2 HR had 93.8%. HDL was reduced in 62% of patients and 38% had normal HDL. Total cholesterol HDL ratio was abnormal in 64% of patients and 36% had normal ratio. Normal VLDL was found in 63% of subjects and only 37% had abnormal VLDL. CRP was normal among 90% of patients. Only 10% had high CRP. High CRP was found in 43.8% among grade 2 HR and 3.6% among grade 1 (Table 1).

Table 1: CRP and hypertensive retinopathy

Hypertensive retinopathy	CRP		Total
	High	Normal	
GRADE 1	3.6%	96.4%	100%
GRADE 2	43.8%	56.2%	100%

4. Discussion

The prevalence of hypertension is increasing all over the world; the aim of the study is to relate hypertensive retinopathy with serum lipid and CRP levels.

The present study involved 100 patients with hypertension having hypertensive retinopathy. In this study minimum age was 40 years and maximum age was 87 years. The mean age group was 61.06±8.49 years. Mean age group of the study conducted by Senghor *et al* [5] was 52.77± 6.3 years. Bastola P *et al* [2] had mean age of 58.5±9.2 years, also Rajendra *et al*[6] had a mean age of 56.50±21.00 years in their study. In present study majority of patients were in their 5th and 6th decade of life as hypertensive retinopathy appears to be markers of cumulative long-term hypertension damage [7].

Among 100 patients who were studied 55% were females and 45% were males. Female to male ratio was 1.2:1. Hence majority of patients were females; this could be because of increased prevalence of hypertension among females compared to males. Before 50 years of age, women have lower prevalence of hypertension than men. After menopause, the prevalence of hypertension increases rapidly in women and surpasses that in men.[8]

Among 100 patients in this study 84% were having Grade 1 hypertensive retinopathy (HR) and remaining were grade 2 (16%). None of them had grade 3 or 4 hypertensive retinopathy. According to Cuspidi *et al* [9] grade 1 and 2 hypertensive retinopathy are the most common type whereas grades 3 and 4 are rare. The study by Ebinc *et al* [10] also shows that grade 1-2 hypertensive retinopathy (55.1%) is more common than other target organ injury. For this reason, recognition of grade 1-2 retinopathy may be more useful than other target organ injuries in the assessment of hypertensive patients. [10] Majority of patients in present study were having grade 1 hypertensive retinopathy which was similar to study conducted by Senghor *et al* [5], Bastola *et al* [2] and Hyung *et al* [11]. This could be because of early detection of target organ damage in the form of retinopathy, due to regular follow up with physician and thus controlling blood pressure adequately so that patient does not progress to later stages of retinopathy.

Among 100 patients 64% had increased waist circumference and remaining 36% had normal waist circumference. Abdominal obesity is associated with increased morbidity and mortality.[12] The main cause of obesity related deaths is cardiovascular disease, for which abdominal obesity is a predisposing factor.[12]

According to Okosun *et al*[13,14] increased waist circumference has been associated with a 1.5-2.0 fold increased risk of hypertension. More importantly, Asian Indians have excess body fat and abdominal adiposity [15] due to which WHO Expert Committee on Obesity in Asian and Pacific populations have revised cut- off points for waist circumference for identifying persons with abdominal obesity.[16] This is because Asian Indians have relatively higher truncal and abdominal fat mass as compared to Caucasians and black population despite similar or less average value of waist circumference and hence cardiovascular diseases can manifest early among Indians at a lower value of waist circumference.[17]

In present study among patients with grade 2 hypertensive retinopathy, 87.5% had increased waist circumference when compared to grade 1 (59.5%) (p 0.033). According to ARIC study, hypertensive retinopathy signs were related to larger waist circumference, an indicator of abdominal obesity [18]. BMI was high among 68% of patients and remaining 32 % had normal BMI. A stable linear relation between adiposity and blood pressure has been reported, independent of age and body fat distribution across developed and developing countries.[19] On the basis of the available data in Asia, the WHO expert consultation concluded that Asians generally have a higher percentage of body fat than white people of the same age, sex, and BMI.[20]

Hence by reducing the waist circumference and maintaining ideal body weight, hypertension could be controlled so that occurrence of complication in the form of retinopathy could be prevented.

Total cholesterol was normal among 51% of patients. High cholesterol was found in 49%. Among grade 2 HR patients, 68.8% had increased cholesterol, while only 45.2 % had increased total cholesterol in grade 1. According to study conducted by Bastola *et al* [2] Total cholesterol was 188± 40.74 (Grade 1 HR), 215.4±33.22 (Grade 2 HR), 219.7±32.65 (Grade 3 HR), 240±19.79 (Grade 4 HR), showing significant difference in the mean serum cholesterol level in different stages of hypertensive retinopathy (p<0.001). Another study conducted by Gupta *et al* [6] showed a positive correlation of hypertensive retinopathy with total cholesterol (P < 0.002). The mean total cholesterol in grade 1, 2, 3 and 4 was 184.83±14.13, 209.36±28.78, 215.32± 32.39, 225.60±30.30 respectively (Table 2). In present study mean total cholesterol among grade 1 and grade 2 was 194.29±40.1 and 224.75±38.1 which was not statistically significant (p 0.085) and was correlated to study conducted by Singh K [21] which showed no significant increase in total cholesterol compared to grades of hypertensive retinopathy. Though there were many studies showing significant relationship between total cholesterol and HR, present study did not show association between them.

Table 2: Comparison of total cholesterol with hypertensive retinopathy

	.Bastola et al [2]	.Gupta *et al*[6]	.Present study
Grade 1 HR	.188±40.74	.184.83±14.13	194.29±40.1
Grade 2 HR	.215.4±33.22	.209.36±28.78	224.75±38.1
Grade 3 HR	.219.7±32.65	.215.32±32.39	.-
.Grade 4 HR	240±19.79	225.60±30.30	-

Normal triglycerides were found in 61% of subjects and remaining 39% had abnormal triglycerides. According to study conducted by Bastola *et al* [2] mean triglycerides was 165±31.02 among grade 1 HR, 169.7±58.5 (grade 2 HR), 200.8±50.33 (grade 3 HR), 225.0 ±7.07 (grade 4 HR) and showed statistically significant difference in mean triglyceride level for different level of HR. Also a study conducted by Gupta *et al* [6] showed similar results with significant association between serum triglycerides and hypertensive retinopathy, with mean triglycerides being 121.56±53.66 (grade 1 HR), 144.77±55.45 (grade 2 HR), 187.93±111.1 (grade 3 HR), 160.43±87.1 (grade 4 HR). In present study Mean triglycerides among grade 1 was 156.22±73.4 and grade 2 was 172.18±75.2 (Table 3). There was no significant relationship between triglycerides and grades of hypertensive retinopathy (p 0.325).

Table 3: Comparison of triglycerides with hypertensive retinopathy

	Bastola *et al* [2]	Gupta *et al* [6]	Present study
Grade 1 HR	165±31.02	121.56±53.66	156.22±73.4
Grade 2 HR	169.7±58.5	144.77±55.45	172.18±75.2
Grade 3 HR	200.8±50.33	187.93±111.1	-
Grade 4 HR	225.0 ±7.07	160.43±87.1	-

LDL was high among 88% of patients and remaining 12 % had normal LDL. According to study conducted by Bastola *et al* [2] mean LDL was 125.1±32.48 (grade 1 HR), 151.1±20.40 (grade 2 HR), 169.3±21.31 (grade 3 HR), 177.5± 30.40 (grade 4 HR) respectively and was raised significantly in people with grade II and higher grades of HR. Study conducted by Gupta *et al* [6] also showed similar findings where increasing level of serum LDL-cholesterol was statistically significant to grades of hypertensive retinopathy (P < 0.0001) (Table 4). According to study done by Badhu *et al* [22], an increased serum level of LDL was associated with hypertensive retinopathy (p<0.0196). In present study 86.9% had high LDL among grade 1 HR, while LDL was high among 93.8% in grade 2 HR patients. Mean LDL was 138.84±38.1 (grade 1 HR) and 162.40±37.0 (grade 2 HR) respectively which was not statistically significant (p 0.440). Sedentary lifestyle and change in food habits have caused increase in LDL cholesterol thus increasing the risk of cardiovascular diseases. Hypertension being the common among cardiovascular diseases, increase in LDL can increase the risk of hypertension. Though there are studies showing positive correlation between LDL and HR, present study does not show relation between them.

Table 4: Comparison of LDL with hypertensive retinopathy

	Bastola *et al* [2]	Gupta *et al* [6]	Present study
Grade 1 HR	125.1±32.48	98±27.4	138.84±38.1
Grade 2 HR	151.1±20.40	132±47.9	162.40±37.0
Grade 3 HR	169.3±21.31	170.12±36.14	-
Grade 4 HR	177.5±30.40	172.98±34.12	-

HDL was reduced in 62% of patients and 38% had normal HDL. There was no significant relationship between HDL and grades of hypertensive retinopathy (p value 0.964). Study conducted by Bastola *et al* [2] and Gupta *et al* [6] also showed similar pattern. Though HDL is known to have antiatherogenic property [23] it did not show relation with hypertensive retinopathy.

Total cholesterol HDL ratio was abnormal in 64% of patients, but there was no significant association with hypertensive retinopathy (p 0.117).

Normal VLDL was found in 63% of subjects and only 37% had abnormal VLDL. There was no statistically significant relationship between VLDL andhypertensive

retinopathy (p 0.603) which was similar to study conducted by Bastola *et al* [2] and Gupta *et al* [6].

Though lipids play a role in development of hypertension and its complications there was no significant association between serum lipids and hypertensive retinopathy in the present study.

In present study, high CRP was found in 43.8% among grade 2 HR and 3.6% among grade 1 which was statistically significant (p 0.000), with mean CRP being 2.51±1.8 (grade 1 HR) and 4.7±3.2 (grade 2 HR). Hypertensive retinopathy was significantly associated with CRP according to the study conducted by Ebinc *et al* [10] (p =0.03). A similar study conducted by Coban *et al* [24] showed CRP to have a positive correlation with degree of HR (p = 0.017). In study by Senghor *et al* [5] there was a significant and proportionate increase in mean values of CRP in grade I (0.51± 0.29 mg/dl) , grade II (0.64 ± 0.46 mg/dl), grade III (0.8 ±0.53 mg/dl) and grade IV (1.17 ± 0.60 mg/dl) of HR (p<0.001). (Table 5)

Table 5: Comparison of CRP with hypertensive retinopathy

Hypertensive Retinopathy	CRP		Total
	High	Normal	
Grade 1	3.6%	96.4%	100%
Grade 2	43.8%	56.2%	100%

It is believed that retinal assessment may be a valuable tool in gathering information regarding systemic micro vascular injury [25]. Inflammation, which has a role in the development of retinopathy in hypertensive patients, may at the same time cause destruction in coronary, cerebral, renal and other similar microvascular structures.[26] Inflammation markers such as CRP may be useful in identifying cardiovascular risk.[10] Retinal examination may be useful in finding the existence of systemic micro vascular injury.[10] Hence CRP plays a role in development of hypertensive retinopathy which is a part of systemic vascular structure. Hence CRP and HR may be closely related to cardiovascular risk. There was a positive correlation between CRP and HR in present study, thus it can be used as a tool to access other cardiovascular risks in hypertensive patients.

5. Conclusion

The present study is to relate hypertensive retinopathy with serum lipid and CRP levels. There was statistically significant association between hypertensive retinopathy and CRP. But there was no significant relationship between hypertensive retinopathy and serum lipids. Limitation of this study was that, none of the patients had grade 3 and 4 hypertensive retinopathy.

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