Original Research Article

A prospective study of correlation between serum uric acid and dyslipidemia in essential hypertension

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Abstract

Background: Hypertension is one of the components of the metabolic syndrome and increased levels of triglycerides, cholesterol, LDL, VLDL, with decreased levels of HDL has been associated with hypertension. Metabolic syndrome comprises a group of parameters that predicts the risk of occurrence of cardiovascular disease and diabetes mellitus.

Aim of the study: To analyze the possibility of correlation existing between fasting serum uric acid levels and fasting serum lipid parameters in Essential hypertension.

Materials and methods: The current study was done at Government Mohan Kumaramangalam Medical College and Hospital, Salem at, Department of Medicine from our inpatient and outpatient departments from August 2017 to August 2018. Group A comprises of 30 healthy individuals aged between 35-65 years. Their BP was recorded < 140/90. Group B comprised of 30 hypertensive individuals aged between 35-65 years and BP was recorded ≥ 140/90. Morning sample blood was drawn after 12-hour fasting. The samples of blood were allowed to stand to clot. Precautions were taken so that the blood did not hemolyse. Serum was separated by centrifugation and analyzed by the standard methods.

Results: Of the hypertensive population, the elevation of blood pressure was higher in the age group of 55 to 65 years, since arteriosclerosis and vascular changes contribute more to them. The mean BMI for hypertensive cases was 23.2 and for cases, it was 22.9. The mean systolic and diastolic blood pressure measured in the hypertensive cases was about 160 mmHg and 103 mmHg respectively. The mean triglyceride level found in hypertensive cases was 219.2 in control population, the mean value was 125. The mean total cholesterol value in hypertensive was 242 mg/dl and in controls, it was 160 mg/dl. The mean LDL level in hypertensive cases was 158 mg/dl and in control group, the mean value

was 90 mg/dl. The mean VLDL in hypertensive cases was 45.6 mg/dl and in the control group, it was 26.7 mg/dl. The mean value of HDL in hypertensive cases was 37.7 mg/dl and in control group, it was 53.7 mg/dl. The elevation of triglyceride, total cholesterol, LDL, VLDL or as an individual parameter elevation was seen about 24 individuals in hypertensive cases, whereas in the control population it was only about 6 cases, most of which was elevated triglyceride levels. The serum uric acid levels found to be elevated in most of the hypertensive cases in comparison to the control population. This clearly depicts the correlation of elevation of serum uric acid with hypertension. In control population, no uric acid elevation was seen.

Conclusion: Dyslipidemia is seen in essential hypertensive individuals. Elevation of triglycerides, rise in total cholesterol, raised LDL and raised VLDL is observed in Essential hypertensive individuals. The levels of HDL are observed to be low in essential hypertensive individuals. Elevation of serum uric acid level is seen in essential hypertensive. Both dyslipidemia and hyperuricemia observed to be elevated with an increase in age in essential hypertensive.

Key words

Hypertension, Lipid Profile Changes, Elevated Uric Acid Level, Coronary Artery Disease.

Introduction

Hypertension is one among the most vital non-communicable diseases contributing to the global burden of morbidity and mortality and one of the vital cause leading on to death [1]. Hypertension has been associated with an increased incidence of cardiovascular pathology, which includes coronary artery heart disease, heart failure, ischemic and hemorrhagic stroke, renal disease, and peripheral arterial disease. It has seemed to be linked with cardiovascular risk factors, and so the risk amount increases with the total weight of risk factors [2]. Even though it is present worldwide, the major toll occurs in the developing nations rather than developed nations due to unawareness and inadequate treatment. Proper educational strategies will help to manage the epidemics of hypertension [3]. Even treatment of hypertension seems to reduce the risks of cardiovascular and renal pathology, majority of the hypertensive group are not treated sufficiently, due to unawareness of the problem. Among hypertensive, renal disease is an important complication, especially with more severe Hypertension [4]. The Asia Pacific cohort studies collaboration clearly demonstrated the log-linear relationship of blood pressure with ischemic and hemorrhagic stroke, Ischemic heart disease, congestive cardiac failure, renal insufficiency, obstructive sleep apnea, till cardiovascular death that continues down to at least 115/75 mmHg [5]. Hypertension is one of the components of the metabolic syndrome and an increased level of triglycerides, cholesterol, LDL, VLDL, with decreased levels of HDL has been associated with hypertension. Metabolic syndrome comprises a group of parameters that predicts the risk of occurrence of cardiovascular disease and diabetes mellitus [6]. Hypertension and dyslipidemia are part and parcel of metabolic syndrome that has clearly shown to increase the risk for cardiovascular morbidity, mortality and for the occurrence of diabetes mellitus. Uric acid is one of the by-products of the metabolism of purine produced in blood from endogenous purine (2/3) substances or from the diet (1/3). Uric acid is considered to be one of the independent risk factors for hypertension and its levels also tend to correlate with the severity of hypertension [7]. Uric acid tends to have a pathogenic part in hypertension mediated by various actions such as inflammation, vascular smooth muscle cell proliferation in renal microcirculation, dysfunction of endothelium and the renin-angiotensin-aldosterone system activation Dyslipidemia has been found associated with elevation of uric acid levels and raise in any one of the lipid parameters has been found to increase the uric acid level [8]. Uric acid is not considered a criterion for the

diagnosis of metabolic syndrome, but some studies have observed a correlation between high levels of uric acid and the metabolic syndrome in different populations [9].

Materials and methods

The current study was done at Government Mohan Kumaramangalam Medical College and Hospital, Salem at, Department of Medicine from our inpatient and outpatient departments from August 2017 to August 2018.

Inclusion criteria: Group A comprised of 30 healthy individuals aged between 35-65 years. Their BP was recorded < 140/90. Group B comprised of 30 hypertensive individuals aged between 35-65 years and BP was recorded ≥ 140/90.

Exclusion criteria: Diabetes mellitus, Ischemic heart disease, Renal disease, History and presence of jaundice, Chronic liver disease, Familial hyperlipidemia, Patients on lipid-lowering drugs, Smoking, Alcoholics, Obese, BMI <25, Gout.

Biochemical Tests: Morning sample blood was drawn after 12-hour fasting. The samples of blood were allowed to stand to clot. Precautions were taken so that the blood did not hemolyse. Serum was separated by centrifugation and analyzed by the standard methods.

Statistical analysis

A Case-control study consisting of 30 controls and 30 cases was undertaken to study the relationship between serum uric acid and lipid parameters. The range, frequencies, percentages, means, standard deviations, chi-square, "t" value and 'p' values were calculated. Student's –t-test was used to test the significance of the difference between quantitative variables. Yate's and Fisher's chi-square tests for qualitative variables. A 'p' value less than 0.05 was taken to denote a significant relationship.

Results

Table - 1 shows the individuals selected for both cases and controls are categorized age wise and stratified into three age categories and looked for any specific increase in the blood pressure, serum lipid profile and serum uric acid. Using the table it was calculated that the mean age of hypertensive cases was about 50.8 years and in controls, it was about 50.4 years. The distribution of cases and controls was equal among different age groups cases had blood pressure > 140/90 mmHg. All controls had blood pressure <140/90 mmHg. The sex distribution was equal between cases and controls. Both in hypertensive cases and also in the controls, both men and women were equally distributed for an effective and comparison.

Table - 1: Age distribution.

Age Group (Years)	Hypertensive Group		Control Group	
	No	**%**	**No**	**%**
35 – 45	8	26.7	9	30
46 – 55	10	33.3	12	40
56 – 65	12	40	9	30
Total	**30**	**100**	**30**	**100**
Range	36 – 64 yrs		36 – 64 yrs	
Mean	50.8 yrs		50.4 yrs	
SD	8.5 yrs		8.6 yrs	
"p"	0.88 Not Significant			

Graph – 1: BMI, height and weight in study population.

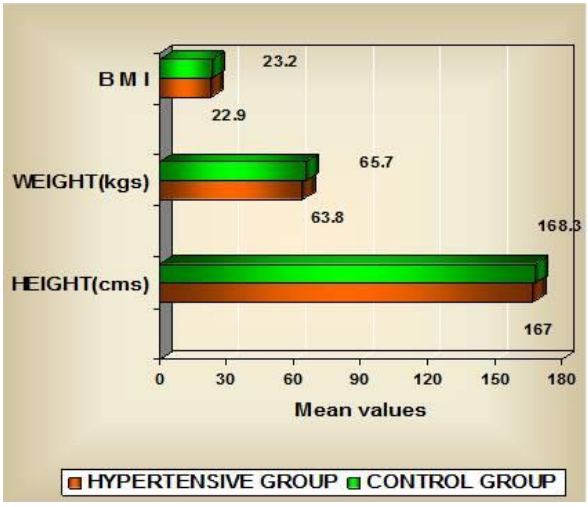

Table - 2: Blood pressure in both the group.

Group	Systolic B.P			Diastolic B.P		
	Range	Mean	SD	Range	Mean	SD
Hypertensive	144 - 178	160.1	10.4	96 – 112	103.1	4.7
Control	110 - 130	120.1	7.6	78 – 84	80.1	0.9
"p"	<0.0001 Significant			<0.0001 Significant		

Table - 3: Triglyceride level.

Group	Triglyceride						
	Normal		Abnormal		Range	Mean	SD
	No	%	No	%			
Hypertensive	8	26.7	22	73.3	118 - 294	219.2	42.3
Control	27	90	3	10	78 - 224	125.1	39.1
"p"	<0.0001 Significant						

Table - 4: Total cholesterol level.

Group	Total Cholesterol						
	Normal		Abnormal		Range	Mean	SD
	No	%	No	%			
Hypertensive	7	23.3	23	76.7	180 – 316	249.7	42.0
Control	28	93.3	2	6.7	120 – 224	160.1	25.3
"p"	<0.0001 Significant						

Table – 5: LDL level.

Group	LDL						
	Normal		Abnormal		Range	Mean	SD
	No	%	No	%			
Hypertensive	9	30	21	70	48 - 259	158.6	50.2
Control	28	93.3	2	6.7	50 - 180	90.1	28.5
"p"	<0.0001 Significant						

Table - 6: VLDL level.

Group	VLDL						
	Normal		Abnormal		Range	Mean	SD
	No	%	No	%			
Hypertensive	10	33.3	20	66.7	28 - 65	45.6	8.6
Control	27	90	3	10	14 - 50	26.7	8.8
"p"	<0.0001 Significant						

Graph - 1 shows the heights, the weight of the individuals were measured and BMI calculated and obese individuals were excluded from the study by the fixed criteria. The mean values calculated for both hypertensive cases and controls were shown in the diagram. The mean BMI for hypertensive cases was 23.2 and for cases, it was 22.9.

Table - 2 shows the blood pressure for both the hypertensive cases and controls were plotted and mean blood pressure for both the study population obtained. All the hypertensive cases

had blood pressure > 140/90mmhg. All the controls had blood pressure <140/90 mmHg.

Table - 3 shows the triglyceride levels were found to be elevated in hypertensive cases when compared to controls. The mean triglyceride level found in hypertensive cases was 219.2 mg/dl. In control population, the mean value was 125mg/dl. The "p" value was <.001, which waist significant denoting the correlation in hypertensive cases when compared to controls.

Table - 7: HDL level.

Group	**HDL**						
	Normal		**Abnormal**		**Range**	**Mean**	**SD**
	No	**%**	**No**	**%**			
Hypertensive	12	40	18	60	23 - 68	37.7	9.6
Control	29	96.7	1	3.3	36 - 80	53.7	10.5
"p"	**<0.0001 Significant**						

Table - 8: Hyperuricemia.

Group	**Hyperuricemia**			
	Present		**Absent**	
	No	**%**	**No**	**%**
Hypertensive	25	83.3	5	16.7
Control	-	-	30	100
"p"	**<0.0001 Significant**			

Table - 9: Dyslipidemia and hyperuricemia.

Dyslipidemia	**Hypertensive Group**				**Controls Group**			
	Hyperuricemia				**Hyperuricemia**			
	Present		**Absent**		**Present**		**Absent**	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Present	24	100	-	-	-	-	7	100
Absent	1	16.7	5	83.3	-	-	23	100
"p"	**<0.0001 Significant**				--			

Table - 4 shows the total cholesterol values were also observed to be elevated in hypertensive cases. In control population, only a few individuals have elevated total cholesterol values. The mean total cholesterol value in hypertensive was 242 mg/dl and in controls, it was 160mg/dl. The "p" value was <.001 which was significantly correlating the relation in hypertensive cases when compared to controls.

The LDL levels were elevated in the hypertensive group when compared to the control population (**Table – 5**). The mean LDL level in hypertensive cases was 158 mg/dl and in control group, the mean value was 90 mg/dl "p" value was <.0001, which was significant showing the correlation of elevated LDL level in a hypertensive population.

The VLDL levels were elevated in hypertensive cases in comparison with the control population (**Table – 6**). The mean VLDL in hypertensive cases was 45.6 and in the control group, it was 26.7. The "p" value was <0.0001, which was statistically significant showing the elevation of VLDL levels in a hypertensive population.

The HDL levels were observed to be decreased in the hypertensive population when compared to controls (**Table – 7**). The mean value of HDL in

hypertensive cases was 37.7 mg/dl and in control group, it was 53.7 mg/dl. The "p" value was <.0001, which was statistically significant showing the correlation of decreased levels of HDL in the hypertensive population.

Table - 8 shows in hypertensive cases, 25 cases had shown elevation of serum uric acid, and no controls had shown the elevation of uric acid. In hypertensive cases, "p" value was significant denoting the vital correlation between the elevation of uric acid in a hypertensive population.

Table - 9 shows in the hypertensive group, most of the individuals, about 80% had dyslipidemia and were associated with an increased level of serum uric acid. In the control population, dyslipidemia was seen only in around 20% of the population and in them also, serum uric acid level was not elevated. The "p" value was significant implying the correlation of the relationship between serum uric acid and dyslipidemia in hypertensive cases, whereas in controls no such relation was seen.

Discussion

Dyslipidemia is seen in most of the hypertensive cases. About 24 out of 30 cases have elevation in lipid parameters [10]. About 80% of the study populations have elevated dyslipidemia observed. In all hypertensive individuals with elevated lipid parameters, it is observed that the serum uric acid level is elevated. The serum uric acid elevates, either with a rise in all of the lipid parameters or if any one of the lipid parameters is elevated, excluding HDL [11]. The rise in serum uric acid is also proportional to the severity of hypertension and also with the age group. In control population, serum uric acid level is not elevated [12]. In control population, only a few have dyslipidemia. About 6 of 30 individuals have dyslipidemia and they too have elevated triglycerides and total cholesterol values alone. Even in that individual with dyslipidemia, serum uric acid level is not elevated. This implies that dyslipidemia is associated with elevation of serum uric acid in hypertensive group, whereas in the control group dyslipidemia is not associated with elevation of serum uric acid. This clearly denotes the correlation of serum uric acid and dyslipidemia in essential hypertension [13]. Dyslipidemia in hypertension is due to lipid deposition in the lumen of the arterial wall, causing atherosclerosis. This increases the resistance to flow of blood in a blood vessel, causing hypertension. HDL-Cholesterol impairs endothelium-dependent dilation. HDL-cholesterol is a protective factor decreased in hypertensive, suggesting more risk of developing a complication of hypercholesterolemia [14]. High cholesterol influence adrenergic stimulation and outcome of target organ damage are more in hypertensive. LDL-cholesterol is vasoconstrictor, mitogenic, proinflammatory and thrombogenic. So its raise in hypertensive is a risk for developing complications [15]. Hypertension is a degenerative process, taking place in blood vessels affecting the blood supply to target organs like Heart, Kidney, and Liver. Damage to these organs is called Target Organ Damage. This degenerative process increases purine metabolism also, rising uric acid levels [16]. In hypertension, there is enhanced proximal tubular reabsorption and depressed tubular secretion of uric acid causing hyperuricemia. Diuretic treatment of hypertension will also cause hyperuricemia. Hyperuricemia is present in 1/3rd cases of hypertension and increased in thiazide treatment [17]. Uric acid is an independent risk factor for atherosclerosis. Uric acid excretion is affected by kidney due to decreased renal perfusion in hypertension [18]. Hypertension complication like CCF, Heart failure has more endothelial dysfunction due to dyslipidemia and raised uric acid. So in all hypertensive, dyslipidemia, and serum uric acid is correlated. Detection of this correlation at an early stage will prevent complications of hypertension [19, 20].

Conclusion

Dyslipidemia is seen in essential hypertensive individuals. Elevation of triglycerides, rise in total cholesterol, raised LDL and raised VLDL is

observed in Essential hypertensive individuals. The levels of HDL are observed to be low in Essential hypertensive individuals. Elevation of serum uric acid level is seen in essential hypertensive. Both dyslipidemia and hyperuricemia observed to be elevated with an increase in age in essential hypertensive. In normotensives, few have elevated triglyceride levels and elevated total cholesterol levels. Though hypertriglyceridemia increase as age increase, it is not associated with hyperuricemia. This concludes that dyslipidemia is correlated to hyperuricemia in essential hypertensive and not in normotensive.

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