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**Original Research Article**

# A STUDY TO ANALYSE AND CORRELATE SERUM URIC ACID, CALCIUM AND LIPID PROFILEIN HYPERTENSIVE PATIENTS, ATTENDING TERTIARY HOSPITAL KANPUR

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## Abstract

**Background:** Hypertension is one among the most vital non communicable diseases contributing to global burden of morbidity and mortality and one of the vital cause leading on to death. **Materials and Methods:** A total 150 subjects are recruited, out of which 50 subject will be newly diagnosed hypertensive, 50 subject hypertension will be more than 3 years and 50 subject at healthy age and gender matched volunteer as control were recruited from IPD & OPD of Rama Medical College Hospital & Research Centre Kanpur. **Result:** Lipid abnormalities are seen in both case hypertensive individuals. Elevation of triglycerides, rise in total cholesterol, raised LDL and raised VLDL is observed in both group hypertensive individuals. The levels of HDL are observed to below in more than 3 year hypertensive individuals and minor low and normal are in newly diagnosed hypertensive patients. Serum uric acid level is moderate increase in newly diagnosed hypertensive is highly increase in more than 3 year hypertensive patients. Serum calcium level is significant in newly diagnosed hypertensive and more than 3 year hypertensive patients. **Conclusion:** Dyslipidemia and hyperuricemia observed to be elevated with increase in newly diagnosed and more than three year in hypertensive patients.

## INTRODUCTION

Hypertension is one among the most vital non communicable diseases contributing to global burden of morbidity and mortality and one of the vital cause leading on to death. Hypertension has been associated with increased incidence of cardiovascular pathology, which includes coronary artery heart disease, heart failure, ischemic and haemorrhagic stroke, renal disease, and peripheral arterial disease. It has been seem to be linked with cardiovascular risk factors, and so the risk amount increases with the total weight of risk factors. Even though it is present worldwide, the major toll occurs in the developing nations rather than developed nations due to unawareness and inadequate treatment. The Asia Pacific cohort studies collaboration clearly demonstrated the log linear relationship of blood pressure with ischemic & haemorrhagic stroke, Ischemic heart disease, congestive cardiac failure, renal insufficiency, obstructivesleep apnea, till cardio vascular death that continue down to at least 115/75 mmHg.[1] Proper educational strategies will help to manage the epidemics of hypertension.[2] Hypertension or high blood pressure has emerged as a leading cause ofthe global burden of disease in both developed as well as developing countries. Data from the National Health And Nutrition Examination Survey (NHANES) have indicated that 50 million or more Americans have high blood pressure warranting some form of treatment.[3] Worldwide prevalence estimates for hypertension may be as much as 1 billion individuals, and approximately 7.1 million deaths per year may be attributable to hypertension.[4]

In India, awareness of hypertension and its complications is very poor .Poor awareness of

normal blood pressure values in hypertension can be important factor hindering BP control.

**Hypertension and Lipid profile:** The major lipids present in blood are cholesterol, fatty acid, and triglycerides. Lipid disorders are common and are associated with an increased risk of atherosclerotic cardiovascular disease. Lipid are insoluble in plasma and are therefore transported in circulation in association with proteins known as lipoproteins, Dyslipidemia are disorder of lipoprotein metabolism. Major lipoprotein comprises of Low-Density lipoproteins (LDL), Very Low- Density lipoproteins (VLDL), and High- Density lipoprotein (HDL). Triglycerides (TG) are carried out by chylomicron, VLDL, LDL, while Cholesterols are carried out by LDL, and HDL. Dyslipidemia has been long recognized as a major biochemical event predisposing to atherogenicity and cardiovascular disease. It is manifested by elevation of plasma concentration of lipoproteins India is currently experiencing increasing trends in mean Cholesterol, LDL Cholesterol, and Triglyceride levels.[5]

**Hypertension and Serum uric acid:** In human, serum uric acid (SUA) is the final oxidation product of purine catabolism. Excessive uric acid production and its decreased excretion by the kidneys are one of the major causes of hyperuricemia. The prevalence of hyperuricemia is rapidly increasing in the international communities; emerging evidence shows that hyperuricemia is now more frequent in the developing nation. Epidemiological studies showed that elevated levels of uric acid in serum are increasingly related to hypertension such as blood lipids, metabolic syndrome and diabetes, cardiovascular disease.[6] Hyperuricemia is considered to be a mediator of proinflammatory endocrine imbalance in the adipose tissue which may be one of the important factors for Dyslipidemia and the inflammatory process that leads to atherogenesis.[7] Serum uric acid is a strong predictor of stroke, Coronary artery disease and metabolic syndrome.[8] The exact role of SUA in these diseases is still the debate and subject of much discussion because it is always accompanied by other risk factor such as diet, Dyslipidemia and obesity.[9] The role of abnormalities of blood lipids and uric acid has been mentioned in relationship to the etiology of coronary disease.[10]

**Lipid Profile and Serum uric acid:** The relationship between serum uric acid and Dyslipidemia is also complex and not fully elucidated. A few studies have been conducted to investigate the association between SUA and lipid profiles in the adult population of India. In this study we aimed to assess the independent relationship between SUA and lipid profile in Indian adult. Few previous studies showed that SUA concentrations were higher in individuals with coronary heart disease than in healthy subjects and elevated SUA was found to be associated with increased cardiovascular morbidity and mortality in the general adult population.[11]

**Hypertension and Serum Calcium:** Calcium is a ubiquitous divalent cation playing a fundamental role in the intra- and extracellular compartments. It is involved in blood coagulation, skeletal mineralization, muscle contraction, and regulation of nerve excitability, and finely regulated by both calcitonin and parathyroid hormone. Despite calcium supplementation being found to be beneficial for bone health in children, young adults, elderly, and menopausal women, there is concern about a possible association with incident cardiovascular disease.[12]

Purpose of my study is to observe the correlation between uric acid along with calcium and lipid and identify uric acid as early marker for hypertension.

## MATERIALS AND METHODS

**Study Setting:** This study was conducted in department of Biochemistry in associated with department of medicine at Rama Medical College Hospital & Research Centre Kanpur. Sample from IPD & OPD of medicine department of Rama Medical College Hospital was collected.

**Study Subjects:** A total 150 subjects are recruited, out of which 50 subjectwill be newly diagnosed hypertensive, 50 subject hypertension will be more than 3 years and 50 subject at healthy age and gender matched volunteer as control were recruited from IPD & OPD ofRama Medical College Hospital & Research Centre Kanpur.

**Study Design:** Case control study.

**Study Period:** This study was conducted from April 2022 to March 2023.

**Inclusion Criteria**
1. Newly diagnosed patients of hypertension.
2. Already diagnosed patients of hypertension for 03 year on regular medication.
3. Healthy age and gender matched volunteer as control.

**Exclusion Criteria**
1. Patients with endocrinological disorders.
2. Patients with liver disorder, renal disease, congestive cardiac failure, pregnant women.
3. Also acutely ill patients, patients on statins and other medications that alter lipid levels heparin.
4. Participants with myeloproliferative disorders and in therapy with cytotoxic drugs, pregnant women lactating mothers & individuals on antihypertensive, hypolipidemic, alcoholics. Known cardio vascular disorder, renal or hepatic disorders and those on anti-gout therapy.
5. Patients with malignancy of any kind.
6. Patient with hypertensive emergency.

**Study Tool:** A pretested questionnaire based on semi- constructed proforma was used as study tool to collect the data including basic profile of participants i.e. age, sex, blood pressure and intake of any lipid lowering drugs.

**Ethical Clearance:** As per Institutional Medical Ethical Committee conducted on 27/07/2022, at

Rama Medical College Hospital and Research Centre Kanpur, Ethical clearance was given.

**Specimen collection:**5ml of blood sample will be collected from antecubital vein into plain vial for uric acid, Calcium & lipid profile.

**Specimen Processing:** Allow clotting at room temperature and centrifuge at 3000 rpm for 15 minutes in the biochemistry department. Serum was separated for analysis of serum uric acid and lipidprofile. The sera were stored at -20˙C until assayed.

**Investigations:** In the present study the following analysis were conducted:

| Lipid Profile Assay | • Total Cholesterol (TC)<br>• Triglycerides (TG)<br>• High Density Lipoprotein-Cholesterol (HDL-C)<br>• Low Density Lipoprotein-Cholesterol (LDL-C)<br>• Very-Low Density Lipoprotein-Cholesterol (VLDL-C) |
|---|---|
| Serum parameters | Uric Acid |
| | Calcium |

**Statistical Analysis**

All the parameters of two groups were analyzed for mean and standard deviation. The results were expressed as Mean ± standard deviation. Data was analyzed by statistical software SPSS Version 29.0. Comparison among two groups was done by using t-Test. Pearson's correlation coefficient was used to find the correlation between Uric Acid, Calcium and Lipid profile.

# RESULTS

The present research work included 150 Subjects (50 newly diagnosed patients of Hypertension, 50 already diagnosed patient of Hypertension more than 03 years and 50 healthy individuals).Gender and age distribution have been done to see the prevalence of hypertensive and healthy among study subjects. Clinical data is studied to find out the Gender and age distribution of cases and controls. The observations of the [Table 1] evince predominantly Male population which is 17.3% in the cases (Newly diagnosed), (More than 3 years) and control. Female population which is 16.0 % in both cases (Newly diagnosed, more than 3 years) and control. Age group 20-40 years which is 13.3% in both cases (Newly diagnosed, more than 3 years) and control. Age group 41-60 years which is 12.0 % in both cases (Newly diagnosed, more than 3 years) and control. Age group 61-80 years which is 8.0 % in cases (Newly diagnosed more than 3 years) and control. The serum level of Uric acid, Calcium and Lipid Profile (TC, TG, HDL- C, VLDL-C and LDL-C) obtain on analyzing specimens collected from study subjects are tabulated.

The mean values and standard deviation of these parameters have been calculated for comparative study of hypertensive (Cases), and Healthy Individuals (Controls). The test of significance of these parameters between cases and controls was performed using student t-Test. Further, individual comparisons among groups have been done using the pearson correlation coefficient and the linearity of data are examined through the scatter diagram.

**Table 1: The gender and age distribution of total subjects (cases and healthy individuals) included in the study.**

| Subject | | Case (Newly Diagnosed) | | Case (More than 3 years) | | Control | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | | |
| Gender | M | 26 | 17.3 | 26 | 17.3 | 26 | 17.3 | 78 | 150 |
| | F | 24 | 16.0 | 24 | 16.0 | 24 | 16.0 | 72 | |
| Age in years | 20-40 | 20 | 13.3 | 20 | 13.3 | 20 | 13.3 | 60 | 150 |
| | 41-60 | 18 | 12.0 | 18 | 12.0 | 18 | 12.0 | 54 | |
| | 61-80 | 12 | 8.0 | 12 | 8.0 | 12 | 8.0 | 36 | |
| Total | | 50 | | 50 | | 50 | | | |
| | | 150 | | | | | | | |

**Table 2: Analysis of variance between cases (Newly diagnosed hypertensive) and controls.(Note: P- value <0.05 considered as statistical Significant; P- value <0.001 considered highly significant.)**

| Parameter | Newly Diagnosed Mean±SD | Control Mean±SD | t | Pvalue |
|---|---|---|---|---|
| Systolic Blood Pressure | 148.44± 12.21 | 119.6± 3.12 | 16.169 | 0.000 |
| Diastolic Blood Pressure | 92.32± 6.69 | 77.4± 11.19 | 8.09 | 0.000 |
| Total Cholesterol | 185.78± 43.16 | 131.46± 41.96 | 6.381 | 0.000 |
| Triglyceride | 163.86± 41.15 | 117.96± 36.88 | 5.873 | 0.000 |
| High Density Lipoprotein | 36.9± 13.72 | 47.38± 10.16 | -4.339 | 0.000 |
| Very Low Density Lipoprotein | 116.1± 47.42 | 60.48± 42.09 | 6.202 | 0.000 |
| Low Density Lipoprotein | 32.77± 8.23 | 23.59± 7.37 | 5.873 | 0.000 |
| Uric Acid | 7.04± 1.84 | 6.31± 1.44 | 2.219 | 0.029 |
| Calcium | 10.5± 1.15 | 9.48± 1.06 | 2.541 | 0.013 |

**Table 3: Analysis of Variance Between Cases (More Than 3 Years Diagnosed Hypertensive)andcontrols. (Note: P-value <0.05 considered as statistical Significant; P- value <0.001 considered highly significant.)**

| Parameter | More than 3yearsMean±SD | ControlMean±SD | t | Pvalue |
|---|---|---|---|---|
| Systolic Blood Pressure | 168.52± 13.98 | 119.6± 3.12 | 24.139 | 0.000 |
| Diastolic Blood Pressure | 100.64± 9.48 | 77.4± 11.19 | 11.2 | 0.000 |

| | | | | |
|---|---|---|---|---|
| Total Cholesterol | 259.9± 86.17 | 131.46± 41.96 | 9.475 | 0.000 |
| Triglyceride | 208.44± 74.31 | 117.96± 36.88 | 7.711 | 0.000 |
| High Density Lipoprotein | 24.04± 13.39 | 47.38± 10.16 | -9.814 | 0.000 |
| Very Low DensityLipoprotein | 194.17± 85.89 | 60.48± 42.09 | 9.882 | 0.000 |
| Low Density Lipoprotein | 41.68± 14.86 | 23.59± 7.37 | 7.711 | 0.000 |
| Uric Acid | 8.05± 1.34 | 6.31± 1.44 | 6.274 | 0.000 |
| Calcium | 10.04± 1.15 | 9.48± 1.06 | 2.5 | 0.014 |

**Table 4: Pearson Correlation between Diastolic BP and Systolic BP in cases and controls.**

| Lab Variable | Systolic Blood Pressure | N | Pearson Correlation "r" value | "P"Value |
|---|---|---|---|---|
| Diastolic Blood Pressure | Newly Diagnosed | 50 | 0.114 | 0.430 |
| | Control | 50 | 0.033 | 0.822 |

**Table5: Pearson Correlation between serum Total cholesterol and SBP in cases and controls.**

| Lab Variable | Systolic Blood Pressure | N | Pearson Correlation "r" value | "P"Value |
|---|---|---|---|---|
| TC(mg/dl) | Newly Diagnosed | 50 | 0.109 | 0.452 |
| | Control | 50 | 0.005 | 0.736 |
| TG(mg/dl) | Newly Diagnosed | 50 | 0.119 | 0.411 |
| | Control | 50 | 0.105 | 0.467 |
| HDL-C(mg/dl) | Newly Diagnosed | 50 | 0.18 | 0.210 |
| | Control | 50 | -0.111 | 0.444 |
| LDL-c(mg/dl) | Newly Diagnosed | 50 | 0.026 | 0.856 |
| | Control | 50 | 0.041 | 0.780 |
| VLDL-c(mg/dl) | Newly Diagnosed | 50 | 0.119 | 0.111 |
| | Control | 50 | 0.105 | 0.467 |
| Calcium (mg/dl) | Newly Diagnosed | 50 | -0.294* | 0.038 |
| | Control | 50 | -0.003 | 0.984 |
| Uric Acid (mg/dl) | Newly Diagnosed | 50 | -0.095 | 0.294 |
| | Control | 50 | -0.153 | 0.289 |

**Table 6: Pearson Correlation between Total Cholesterol and Diastolic BP in cases and controls.**

| Lab Variable | Systolic Blood Pressure | N | Pearson Correlation "r" value | "P" Value |
|---|---|---|---|---|
| TC(mg/dl) | More than3Years | 50 | 0.309 | 0.029 |
| | Control | 50 | 0.005 | 0.974 |
| TG(mg/dl) | More than3Years | 50 | 0.269 | 0.059 |
| | Control | 50 | 0.002 | 0.987 |
| HDL-C(mg/dl) | More than3Years | 50 | 0.006 | 0.969 |
| | Control | 50 | 0.077 | 0.595 |
| LDL-c(mg/dl) | More than3Years | 50 | 0.262 | 0.066 |
| | Control | 50 | 0.013 | 0.926 |
| VLDL-c(mg/dl) | More than3Years | 50 | 0.269 | 0.059 |
| | Control | 50 | 0.002 | 0.987 |
| Calcium (mg/dl) | More than3Years | 50 | 0.011 | 0.938 |
| | Control | 50 | 0.211 | 0.141 |
| Uric Acid (mg/dl) | More than3Years | 50 | -0.122 | 0.399 |
| | Control | 50 | 0.077 | 0.594 |

## DISCUSSION

The present study was conducted at Rama Medical College, Hospital & Research Centre, Kanpur and Uttar Pradesh, India with the objective to study A study to analyse and correlate serum uric acid, calcium and lipid profile in Hypertensive patients, attending tertiary Hospital Kanpur and compare it with matched healthy individuals in the population.

**Gender and Blood Pressure Elevation:** According to [Table 1] in newly diagnosed hypertensive patient the value of male is minor increases as comparison to female, in more than three years hypertensive patients the value of male is highly increases as comparison to female and in control value of male is also increases as compare to female.

**Age and Blood Pressure Elevation:** Blood pressure elevation is observed as the age group increases. As age increases, a rise in blood pressure elevation is observed. The level of blood pressure rise is observed more in 20-40 year age group. Also more number of hypertensive is observed in 41-60 age groups. Blood pressure rises with age and this rise is observed more in age group 61-80 years age groups and this shows the blood pressure elevation is associated with rise in age groups. [Table1] shows the relation between age group and Hypertension.

**Hypertension and Dyslipidemia:** An elevated level of triglycerides, LDL, VLDL and decreased level of HDL is observed more in hypertensive group. Most of the individuals in hypertensive group have elevation of lipid parameters as a whole or rise in any one of the individual lipid parameter, excluding HDL. In newly diagnosed hypertensive case 40 out of 50 cases in the hypertensive group has observed to have Dyslipidemia, either as total increase in all lipid parameters or increase in any one of the lipid parameter, excluding HDL. In more than 3 year hypertensive case 43 out of 50 cases in the hypertensive group has observed to have

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Dyslipidemia, either as total increase in all lipid parameters or increase in any one of the lipid parameter and HDL is decreased.

In control population only few of the individuals have Dyslipidemia; most of the control population does not have any lipid abnormality. Only 4 of 30 have increased triglycerides and 2 of them have increased cholesterol levels. So, about 80% of hypertensive populations have Dyslipidemia.

In control population, only 08 cases have Dyslipidemia and they too have only increased triglyceride levels. Also the rise in lipid parameters is more with age group, more seen in 61-80 years age group and the elevation also increases with increase in blood pressure. In the present study, the mean ± SD levels of newly diagnosed and more than 3 year hypertensive were significantly higher in cases than that of healthy controls also lipid profile (CHO, TAG, HDL, LDL and VLDL)shows a statistically significant betweenboth cases and controls. Similar findings were reported by Simalet. et al,[13] Tao-chung et al,[14] Sathiya et al.[15][Table2].

**Hypertension and serum uric acid:** Uric acid elevation is seen in most of the individuals in hypertensive group. In more than 3 year hypertensive case about 42 of 50 people have elevation of serum uric acid and its elevation is directly proportional to rise in blood pressure and newly diagnosed hypertensive case about 32 of 50 people have elevation of serum uric acid. This implies that serum uric acid level is an independent risk factor in Hypertension and its level also correlates with the severity of Hypertension. Uric acid level is not elevated in control group. This shows that uric acid elevation is seen in hypertensive group and not in control.

According to Table-2 the mean ± SD levels of newly diagnosed and more than 3-year hypertensive were significantly higher in cases than that of healthy controls also Serum uric acid shows a statistically significant between both cases and controls. Similar findings were reported by Pradeep. et al,[16] Shilpa et al,[17]Sathiya et al.[18]

**Dyslipedemia and uric acid elevation:** Dyslipidemia is seen in most of the hypertensive cases. About 83 out of 100 cases have elevation in lipid parameters. About 80% of 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 rise in all of lipid parameters or if any one of the lipid parameter is elevated, excluding HDL.

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. In control population, only few have Dyslipidemia. About 46 of 100 individuals have Dyslipidemia and they too have elevated triglycerides and total cholesterol values alone. Even in those 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, where as in control group Dyslipidemia is not associated with elevation of serum uric acid. Similar findings were reported by Simalet. et al,[19]Minkookson et al,[20]Sadaquaret al.[21]

This clearly denotes the correlation of serum uric acid and Dyslipidemia in essential Hypertension Dyslipidemia in Hypertension is due to lipid deposition in lumen of arterial wall, causing atherosclerosis. This increases the resistance to flow of blood in blood vessel, causing Hypertension. HDL-Cholesterol impairs endothelium dependent dilation. HDL-cholesterol is a protective factor decreased in hypertensive, suggesting more risk of developing complication of hypercholesterolemia.[22] High cholesterol influence adrenergic stimulation and outcome of target organ damage is more in hypertensive. LDL-cholesterol is vasoconstrictor, mitogenic, proinflammatory and thrombogenic. So its raise in hypertensive is a risk for developing complications.

Hypertension is a degenerative process, taking place in blood vessels affecting blood supply to target organs like Heart, Kidney and Liver. Damage to these organs is called Target Organ Damage.[23] These degenerative process increases purine metabolism also, rising uric acid levels. In Hypertension, there is enhanced proximal tubular reabsorbtion and depressed tubular secretion of uric acid causing hyperuricemia. Diuretic treatment of Hypertension will also cause hyperuricemia. Hyperuricemia is present in 1/3 rd cases of Hypertension and increased in thiazide treatment. Uric acid is an independent risk factor for atherosclerosis. Uric acid excretion is affected by kidney due to decreased renal perfusion in Hypertension.

Hypertension complication like CCF, Heart failure has more endothelial dysfunction due to Dyslipidemia and raised uric acid. So in all hypertensive, Dyslipidemia and SUA is correlated. Detection of this correlation at an early stage will prevent complications of Hypertension.

**Hypertension and serum calcium:** Hypertension is a multi‑ factorial disorder in which various physiological mechanisms participate to elevate BP.[24] Many hypotheses were proposed about the possible mechanisms underlying essential hypertension including derangements in serum electrolytes and water balance. One of the physiologically important ions in the serum is calcium. The present study shows significant difference in serum calcium in hypertensive group compared with newly diagnosed more than 3 year hypertensive case which is consistent with the findings of Kosch et al.[25] However the results are contradictory with that of others,[26]who reported adecrease in serum calcium in patients' with essential hypertension compared with control subjects. Serum calcium levels were significantly

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decreased in both males and females with essential hypertension and their first‑degree relatives when compared with the normotensive controls. Reichel et al,[27] also reported reduced calcium in males with elevated DBP.

According to Table-5, & 6 the serum calcium mean ± SD levels of more than 3 year hypertensive and newly diagnosed was significantly higher, in cases than that of healthy controls are shows a statistically no significant.

## CONCLUSION

This study has showed that lipid abnormalities are seen in both case hypertensive individuals. Elevation of triglycerides, rise in total cholesterol, raised LDL and raised VLDL is observed in both group hypertensive individuals. The levels of HDL are observed to be low in more than 3 year hypertensive individuals and minor low and normal are in newly diagnosed hypertensive patients. Serum uric acid level is moderate increase in newly diagnosed hypertensive is highly increase in more than 3 year hypertensive patients. Serum calcium level is significant in newly diagnosed hypertensive and more than 3 year hypertensive patients. Dyslipidemia and hyperuricemia observed to be elevated with increase in newly diagnosed and more than three year in hypertensive patients. This concludes that lipid abnormalities are correlated to hyperuricemia in both newly diagnosed hypertensive and more than 3 year hypertensive patients.

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