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Original Article

Evaluation of Serum Uric Acid, Lipid Profile, and Fasting Blood Glucose in Patients with Hypertension: A Cross-Sectional Observational Study

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ABSTRACT

Background: Hypertension frequently coexists with metabolic abnormalities that intensify cardiovascular risk. Serum uric acid, lipid derangements, and impaired fasting glucose are increasingly recognized as important biochemical correlates in hypertensive patients.
Objectives: To evaluate serum uric acid, lipid profile, and fasting blood glucose in patients with hypertension and to examine their association with hypertension severity.
Methods: This hospital-based cross-sectional observational study was conducted on one hundred adult patients with hypertension were enrolled. Clinical details, body mass index, and duration of hypertension were recorded. Fasting venous blood samples were analyzed for serum uric acid, total cholesterol, triglycerides, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, and fasting blood glucose. Comparative analysis was performed between Stage 1 and Stage 2 hypertension, and correlation coefficients were calculated for systolic and diastolic blood pressure.
Results: The mean age of participants was 54.8 ± 10.6 years, and 58.0% were men. Hyperuricemia was present in 38.0% of patients. Elevated total cholesterol, triglycerides, and low-density lipoprotein cholesterol were observed in 46.0%, 52.0%, and 49.0% of patients, respectively, whereas 41.0% had low high-density lipoprotein cholesterol. Fasting blood glucose was normal in 47.0% of patients, impaired in 31.0%, and in the diabetic range in 22.0%. Patients with Stage 2 hypertension had significantly higher serum uric acid, total cholesterol, triglycerides, low-density lipoprotein cholesterol, and fasting blood glucose, along with lower high-density lipoprotein cholesterol, than those with Stage 1 hypertension.
Conclusion: Hypertensive patients demonstrated a substantial burden of hyperuricemia, dyslipidemia, and abnormal fasting blood glucose. More severe hypertension was associated with a more adverse biochemical profile. Routine metabolic evaluation in hypertensive patients could support earlier risk stratification and integrated management.

Keywords: *hypertension; serum uric acid; lipid profile; fasting blood glucose; dyslipidemia; hyperuricemia.*

INTRODUCTION

Hypertension remains one of the most important modifiable risk factors for cardiovascular, cerebrovascular, and renal morbidity worldwide. Its clinical significance extends beyond elevated arterial pressure alone because hypertension frequently clusters with other metabolic abnormalities that together accelerate vascular injury and target-organ damage[1]. Among these associated disturbances, serum uric acid elevation, dyslipidemia, and altered glucose metabolism have received growing attention in recent years. These abnormalities are not merely parallel findings; they often reflect shared

pathophysiological pathways involving insulin resistance, oxidative stress, endothelial dysfunction, low-grade inflammation, sympathetic overactivity, and activation of the renin-angiotensin system [2-4].

Serum uric acid has emerged as a biomarker and possible mediator of vascular risk in patients with raised blood pressure. Experimental and epidemiological evidence indicates that hyperuricemia is associated with endothelial dysfunction, reduced nitric oxide bioavailability, vascular smooth muscle proliferation, and renal microvascular changes that can contribute to the development and progression of hypertension [2-4]. Several studies have also shown that elevated uric acid tends to coexist with obesity, adverse lipid parameters, and disturbed glucose homeostasis, suggesting that it is closely linked to the broader cardiometabolic milieu rather than acting as an isolated laboratory abnormality [13,14].

Abnormal lipid metabolism is another important component of cardiovascular risk in hypertensive individuals. Elevated total cholesterol, triglycerides, and low-density lipoprotein cholesterol, together with reduced high-density lipoprotein cholesterol, have been reported in a substantial proportion of hypertensive patients across different populations [5-8]. The coexistence of hypertension and dyslipidemia is clinically relevant because both conditions act synergistically to promote atherosclerosis, arterial stiffness, and cardiovascular events. Earlier cross-sectional studies have documented a high prevalence of dyslipidemia in hypertensive cohorts, while more recent analyses have further shown a relationship between worsening lipid indices and hypertension severity [5-8].

Disordered glucose metabolism represents a third critical axis in the metabolic profile of hypertensive patients. Impaired fasting glucose and overt hyperglycemia are common in individuals with hypertension, and available evidence suggests that higher fasting glucose levels are associated with a higher prevalence and future risk of hypertension [9-12]. Shared mechanisms such as insulin resistance, vascular inflammation, increased arterial stiffness, and altered sodium handling likely explain this close relationship. From a clinical standpoint, simultaneous assessment of uric acid, lipid parameters, and fasting blood glucose can provide a broader estimate of cardiometabolic burden in hypertensive patients and can help identify individuals who require more intensive preventive strategies [9].

In this context, the present study was undertaken to evaluate serum uric acid, lipid profile, and fasting blood glucose in patients with hypertension attending Government Medical College, Bhadradri Kothagudem, Telangana, India. The objectives of the study were to determine the distribution of these biochemical parameters in hypertensive patients, to compare them between Stage 1 and Stage 2 hypertension, and to assess their correlation with systolic and diastolic blood pressure levels.

METHODOLOGY

Study design and setting

This hospital-based cross-sectional observational study was conducted at Government Medical College, Bhadradri Kothagudem, Telangana, India, from January 2025 to June 2025. The study evaluated selected biochemical parameters in patients with hypertension and their relationship with blood pressure severity. Institutional Ethics Committee approval was obtained, and written informed consent was secured from all participants before enrollment.

Study population

A total of 100 adult patients with hypertension attending the outpatient or inpatient services during the study period were included. Consecutive eligible patients were recruited to provide a practical hospital-based profile of hypertensive individuals commonly encountered in routine clinical practice.

Inclusion criteria

Adults aged 18 years and above with documented hypertension were included. Hypertension was considered present on the basis of prior diagnosis, current antihypertensive treatment, or blood pressure readings in the hypertensive range at evaluation. For stage-wise analysis, patients were categorized as Stage 1 hypertension when systolic blood pressure was 140–159 mmHg and/or diastolic blood pressure was 90–99 mmHg, and as Stage 2 hypertension when systolic blood pressure was ≥160 mmHg and/or diastolic blood pressure was ≥100 mmHg.

Exclusion criteria

Patients with pregnancy-induced hypertension, chronic kidney disease, known gout, chronic liver disease, acute febrile illness, endocrine disorders affecting lipid or glucose metabolism, or current uric acid-lowering therapy were excluded. Patients unwilling to participate and those with incomplete clinical or biochemical data were also excluded.

Data collection

A structured proforma was used to record age, sex, duration of hypertension, and relevant treatment history. Anthropometric assessment was performed and body mass index was categorized as normal, overweight, or obese using standard clinical cutoffs. Blood pressure was measured in the sitting position after adequate rest using a calibrated sphygmomanometer. Two readings were taken at an interval of at least five minutes, and the average value was used for analysis.

Biochemical analysis

After an overnight fast of 8–12 hours, venous blood samples were collected under aseptic precautions. Serum uric acid, total cholesterol, triglycerides, and high-density lipoprotein cholesterol were measured by standard enzymatic methods using an automated biochemistry analyzer. Low-density lipoprotein cholesterol was estimated by the routine laboratory method when appropriate. Total cholesterol ≥200 mg/dL, triglycerides ≥150 mg/dL, and low-density lipoprotein cholesterol ≥130 mg/dL were considered elevated. High-density lipoprotein cholesterol below the accepted reference range was categorized as low. Fasting blood glucose was grouped as normal (<100 mg/dL), impaired fasting glucose (100–125 mg/dL), and diabetic range (≥126 mg/dL).

Statistical analysis

Data were entered into Microsoft Excel and analyzed using standard statistical software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Independent sample t test was used to compare mean biochemical parameters between Stage 1 and Stage 2 hypertension. Pearson correlation coefficients were calculated to assess the relationship of serum uric acid, lipid parameters, and fasting blood glucose with systolic and diastolic blood pressure. A p value <0.05 was considered statistically significant.

RESULTS

A total of 100 patients with hypertension were included in the study and analyzed. The mean age of the study population was 54.8 ± 10.6 years. Most participants belonged to the 50–59 years age group [31.0%], followed by 60–69 years [23.0%] and 40–49 years [22.0%]. Men constituted 58.0% of the study population, while women accounted for 42.0%. Stage 2 hypertension was observed in 56.0% of patients, whereas 44.0% had Stage 1 hypertension. Nearly half of the participants [48.0%] had hypertension for less than 5 years. Overweight and obesity were common, together accounting for 68.0% of the study population [Table 1].

Table 1. Baseline characteristics of the study population [n = 100]

Variable	Category	n	%
Age group [years]	<40	14	14.0
	40–49	22	22.0
	50–59	31	31.0
	60–69	23	23.0
	≥70	10	10.0
Sex	Male	58	58.0
	Female	42	42.0
Hypertension stage	Stage 1	44	44.0
	Stage 2	56	56.0
Duration of hypertension	<5 years	48	48.0
	5–10 years	32	32.0
	>10 years	20	20.0
BMI category	Normal	32	32.0
	Overweight	41	41.0
	Obese	27	27.0

Biochemical abnormalities were frequently observed among hypertensive patients. The mean serum uric acid level was 6.3 ± 1.4 mg/dL, and hyperuricemia was present in 38.0% of patients. The mean total cholesterol, triglycerides, LDL cholesterol, HDL cholesterol, and fasting blood glucose were 204.8 ± 39.6 mg/dL, 168.4 ± 51.8 mg/dL, 131.6 ± 34.2 mg/dL, 42.8 ± 8.6 mg/dL, and 113.4 ± 28.6 mg/dL, respectively. Elevated total cholesterol was seen in 46.0% of patients, hypertriglyceridemia in 52.0%, elevated LDL cholesterol in 49.0%, and low HDL cholesterol in 41.0%. Based on fasting blood glucose values, 47.0% had normal glucose levels, 31.0% had impaired fasting glucose, and 22.0% had values in the diabetic range [Table 2].

Table 2. Serum uric acid, lipid profile, and fasting blood glucose among hypertensive patients [n = 100]

Parameter	Mean ± SD	Category	n	%
Serum uric acid [mg/dL]	6.3 ± 1.4	Normal	62	62.0
		Elevated	38	38.0
Total cholesterol [mg/dL]	204.8 ± 39.6	<200	54	54.0
		≥200	46	46.0
Triglycerides [mg/dL]	168.4 ± 51.8	<150	48	48.0
		≥150	52	52.0
LDL cholesterol [mg/dL]	131.6 ± 34.2	<130	51	51.0
		≥130	49	49.0
HDL cholesterol [mg/dL]	42.8 ± 8.6	Normal	59	59.0
		Low	41	41.0
Fasting blood glucose [mg/dL]	113.4 ± 28.6	<100	47	47.0
		100–125	31	31.0
		≥126	22	22.0

When biochemical parameters were compared according to hypertension stage, patients with Stage 2 hypertension had significantly higher mean serum uric acid, total cholesterol, triglycerides, LDL cholesterol, and fasting blood glucose than those with Stage 1 hypertension. In contrast, mean HDL cholesterol was significantly lower in patients with Stage 2 hypertension. These findings indicate that worsening blood pressure status was associated with an unfavorable metabolic profile [Table 3].

Table 3. Comparison of biochemical parameters according to hypertension stage

Parameter	Stage 1 [n = 44] Mean ± SD	Stage 2 [n = 56] Mean ± SD	p-value
Serum uric acid [mg/dL]	5.8 ± 1.2	6.7 ± 1.4	0.001
Total cholesterol [mg/dL]	192.6 ± 34.1	214.3 ± 40.8	0.006
Triglycerides [mg/dL]	151.2 ± 46.4	181.9 ± 52.3	0.003
LDL cholesterol [mg/dL]	121.4 ± 28.6	139.7 ± 35.1	0.008
HDL cholesterol [mg/dL]	45.9 ± 7.9	40.3 ± 8.4	0.001
Fasting blood glucose [mg/dL]	103.8 ± 21.6	121.0 ± 31.4	0.002

Correlation analysis further demonstrated a significant positive relationship of systolic blood pressure with serum uric acid, total cholesterol, triglycerides, LDL cholesterol, and fasting blood glucose, while HDL cholesterol showed a negative correlation. Similar, though slightly weaker, associations were noted with diastolic blood pressure. Fasting blood glucose and serum uric acid showed the strongest positive correlations with systolic blood pressure in the study population [Table 4].

Table 4. Correlation of biochemical parameters with blood pressure levels

Parameter	Correlation with SBP [r]	p-value	Correlation with DBP [r]	p-value
Serum uric acid	0.34	0.001	0.27	0.007
Total cholesterol	0.28	0.005	0.22	0.028
Triglycerides	0.31	0.002	0.25	0.012
LDL cholesterol	0.29	0.004	0.23	0.021

Parameter	Correlation with SBP [r]	p-value	Correlation with DBP [r]	p-value
HDL cholesterol	-0.26	0.009	-0.20	0.045
Fasting blood glucose	0.37	<0.001	0.30	0.002

Overall, the results showed that hypertensive patients commonly exhibited hyperuricemia, dyslipidemia, and deranged fasting blood glucose values. Patients with more severe hypertension demonstrated significantly poorer biochemical profiles, suggesting a close association between blood pressure elevation and metabolic abnormalities.

DISCUSSION

The present study demonstrated that hypertensive patients carried a substantial burden of biochemical abnormalities involving serum uric acid, lipid fractions, and fasting blood glucose. Hyperuricemia was identified in 38.0% of participants, and mean serum uric acid was higher among patients with Stage 2 hypertension than among those with Stage 1 disease. These findings are in line with previous work indicating that elevated serum uric acid is closely linked to blood pressure elevation and may reflect both vascular injury and adverse metabolic status. Reviews and meta-analytic evidence suggest that uric acid is not merely an associated marker but may participate in endothelial dysfunction, oxidative stress, renal microvascular injury, and activation of neurohormonal pathways that sustain hypertension [4]. The positive correlation observed in the present study between serum uric acid and both systolic and diastolic blood pressure supports this broader biological association.

Dyslipidemia was also highly prevalent in the study cohort. Elevated triglycerides, total cholesterol, and LDL cholesterol, together with reduced HDL cholesterol, were common abnormalities. Patients with Stage 2 hypertension showed significantly worse lipid parameters, indicating clustering of cardiovascular risk with increasing disease severity. This pattern is comparable to observations from studies on hypertensive populations in Nigeria and Ethiopia, where dyslipidemia was reported in a large proportion of patients and abnormal lipid fractions were frequent among those with longstanding or poorly controlled blood pressure [5-7]. Similarly, larger cross-sectional evidence has demonstrated significant associations between hypertension and atherogenic lipid indices, especially total cholesterol and LDL cholesterol [8]. The coexistence of hypertension and dyslipidemia has major clinical implications because both conditions accelerate arterial damage and heighten the probability of future cardiovascular events.

Abnormal glucose metabolism represented another important finding in the present study. More than half of the patients had either impaired fasting glucose or fasting blood glucose in the diabetic range. Mean fasting blood glucose was significantly higher in Stage 2 hypertension, and blood glucose showed the strongest positive correlation with systolic blood pressure among the biochemical variables studied. These findings are consistent with prior studies showing that higher fasting glucose is associated with prevalent hypertension, impaired fasting glucose is frequent among hypertensive patients, and elevated fasting glucose predicts future hypertension in population-based cohorts [9-12]. This relationship likely reflects shared mechanisms such as insulin resistance, sympathetic overactivity, vascular inflammation, and endothelial dysfunction.

An additional strength of the present findings lies in the integrated interpretation of uric acid, lipids, and glucose. Previous studies have shown that serum uric acid is linked not only with blood pressure but also with triglycerides, HDL cholesterol, and fasting glucose, suggesting that these parameters frequently move together within a common cardiometabolic framework [13,14]. The present study reproduced that pattern clinically, with worse biochemical profiles accompanying more severe hypertension. Taken together, these results support the value of routine metabolic screening in hypertensive patients so that hyperuricemia, dyslipidemia, and abnormal fasting glucose can be identified early and managed in a coordinated manner.

Limitations

This study had several limitations. The sample size was modest and drawn from a single tertiary-care institution, which restricts generalizability. Its cross-sectional design did not permit causal or temporal inference. Detailed analysis of antihypertensive drug class, dietary intake, renal function markers, alcohol use, and physical activity was not performed. A normotensive comparison group was not included, limiting direct between-group interpretation.

CONCLUSION

This study showed that patients with hypertension had a considerable burden of hyperuricemia, dyslipidemia, and abnormal fasting blood glucose. Elevated serum uric acid, high total cholesterol, high triglycerides, elevated LDL cholesterol, low HDL cholesterol, and impaired fasting glucose were common findings in this cohort. Patients with Stage 2 hypertension exhibited significantly more adverse biochemical values than those with Stage 1 hypertension, and these variables correlated with both systolic and diastolic blood pressure. These findings emphasize that hypertension should be

approached as part of a broader cardiometabolic disorder. Routine assessment of uric acid, lipid profile, and fasting blood glucose can improve risk stratification and support more comprehensive management in hypertensive patients.

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