Section: General Medicine

Original Research Article

ASSOCIATION OF SERUM URIC ACID LEVELS WITH HYPERTENSION AND CARDIOVASCULAR EVENTS IN A TERITARY CARE HOSPITAL, GOVERNMENT GENERAL HOSPITAL, KAKINADA.: A PROSPECTIVE STUDY

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ABSTRACT

Background: Hyperuricemia has been increasingly recognized as a potential risk factor for hypertension and cardiovascular disease. This study aimed to evaluate the association between serum uric acid levels, hypertension, and cardiovascular events in a hospital-based population.

Materials and Methods: A prospective observational study was conducted on 100 adult participants. Detailed demographic, clinical, and biochemical data, including serum uric acid levels and blood pressure measurements, were collected. Participants were classified into hypertensive and normotensive groups, and the occurrence of cardiovascular events such as acute coronary syndrome, stroke, and heart failure was recorded. Statistical analyses were performed to assess the association between serum uric acid levels, hypertension, and cardiovascular outcomes.

Results: Among 100 participants, the mean age was 51.6 ± 12.8 years, with males comprising 58% of the study population. Hypertension was present in 56% of participants. The mean serum uric acid level was significantly higher in hypertensive individuals (7.2 ± 1.0 mg/dL) compared to normotensive individuals (5.8 ± 0.9 mg/dL) ($p < 0.001$). Elevated uric acid levels (>7.0 mg/dL) were more prevalent in hypertensive participants (39.3%) than in normotensives (13.7%). Cardiovascular events occurred in 10% of participants, with higher mean serum uric acid levels observed among these cases. A positive correlation was noted between serum uric acid levels and both systolic and diastolic blood pressures.

Conclusion: Serum uric acid levels were significantly associated with hypertension and cardiovascular events. Routine assessment of uric acid levels may help identify individuals at higher risk for hypertension and cardiovascular morbidity.

Keywords: Serum uric acid, Hypertension, Cardiovascular events, Hyperuricemia, Risk factors.

INTRODUCTION

Hypertension continues to be a major global public health concern, contributing substantially to cardiovascular morbidity and mortality. While traditional risk factors such as high sodium intake, obesity, sedentary lifestyle, and genetic predisposition are well-established, recent studies have increasingly focused on the role of serum uric acid (SUA) as a potential modifiable risk factor in the development and progression of hypertension and its complications.

Uric acid, historically regarded as a biologically inert end-product of purine metabolism, is now recognized as a biologically active molecule capable of inducing endothelial dysfunction, oxidative stress, and vascular inflammation. These pathophysiological processes may promote arterial stiffness, renal microvascular injury, and activation of the renin-angiotensin system, thereby contributing to increased blood pressure and cardiovascular risk.[1,2]

Evidence from both longitudinal cohorts and meta-analyses has confirmed that elevated SUA levels are significantly associated with higher cardiovascular and all-cause mortality among hypertensive individuals. For instance, a recent cohort study in China found that hypertensive patients with elevated SUA had a greater risk of both cardiovascular and overall mortality compared to those with normal uric acid levels.[1] Similarly, a comprehensive meta-analysis confirmed that hyperuricemia is independently linked with cardiovascular events and mortality in hypertensive populations, even after adjusting for conventional risk factors.[2]

In the Indian context, D K et al. reported a strong association between hyperuricemia and established cardiovascular risk factors, underscoring the need for SUA evaluation in high-risk individuals.[3] Studies from China and other East Asian populations have also demonstrated that elevated SUA levels are linked with higher incidence of cardiovascular diseases, particularly among middle-aged and elderly individuals.[4] Additionally, in patients with moderate chronic kidney disease, Navaneethan and Beddhu found that higher uric acid levels predicted cardiovascular events and mortality, highlighting the broader implications of hyperuricemia across various risk strata.[5] Despite this growing body of evidence, data from tertiary care centers in India remain sparse. Understanding the clinical significance of serum uric acid levels in hypertensive individuals may provide valuable insights into risk stratification and help guide preventive cardiovascular care.

This prospective study was undertaken to assess the association between serum uric acid levels, hypertension status, and cardiovascular events among adults attending a tertiary care hospital in Kakinada. By elucidating this relationship, the study aims to highlight the clinical utility of serum uric acid as a potential biomarker for cardiovascular risk.

MATERIALS AND METHODS

Study Design and Setting

This prospective observational study was conducted at Rangaraya Medical College (RMC), Government General Hospital, Kakinada, a tertiary care teaching hospital in Andhra Pradesh, India. The study aimed to investigate the association between serum uric acid levels, hypertension, and the incidence of cardiovascular events in adult patients attending the hospital.

Study Duration

The study was carried out over a period of three months, from March 20, 2025, to June 20, 2025, with an additional one-month follow-up period to monitor for the development of cardiovascular events among participants.

Study Population

A total of 100 adult participants aged 18 years and above were enrolled through consecutive sampling. Participants were either normotensive or diagnosed with hypertension based on standard clinical criteria. Individuals with secondary causes of hypertension, chronic kidney disease (Stage 3 and above), or those on uric acid-lowering therapy were excluded to avoid confounding effects.

Data Collection

After obtaining informed consent, comprehensive demographic and clinical data were collected using a structured proforma. Blood pressure measurements were recorded using a standardized digital sphygmomanometer, and participants were categorized as hypertensive or normotensive based on JNC-8 guidelines. Venous blood samples were obtained in a fasting state for serum uric acid estimation, measured using an enzymatic colorimetric method on an automated biochemistry analyzer.

Outcome Assessment

Participants were followed up for one month post initial assessment to document the incidence of cardiovascular events, including acute coronary syndrome, stroke, and congestive heart failure. Events were confirmed based on clinical diagnosis, supported by relevant investigations such as ECG, cardiac enzymes, and imaging as required.

Statistical Analysis

Descriptive statistics were expressed as mean ± standard deviation for continuous variables and frequency (%) for categorical variables. The association between serum uric acid levels and hypertension was analyzed using the Chi-square test for categorical data and Student's t-test for continuous variables. A p-value of <0.05 was considered statistically significant. Data analysis was performed using SPSS version 26.0.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee (IEC/RMC/2025/1404) of Rangaraya Medical College, Kakinada. Informed consent was taken from all participants, ensuring confidentiality, voluntary participation, and adherence to ethical guidelines.

RESULTS

A total of 100 participants were included in the present study.

Baseline Characteristics

The baseline demographic characteristics of the participants are summarized in Table 1. The majority of participants were in the 46–60 years age group

(38%), followed by 31–45 years (26%). Males constituted 58% of the study population, and females comprised 42%. The prevalence of hypertension was noted in 56% of participants, while 44% were normotensive.

Clinical and Biochemical Parameters

The mean systolic blood pressure was 138 ± 18 mmHg, and the mean diastolic blood pressure was 88 ± 12 mmHg. The overall mean serum uric acid level was 6.8 ± 1.2 mg/dL. These findings are detailed in Table 2.

Association Between Serum Uric Acid Levels and Hypertension

A significant association was observed between serum uric acid levels and the presence of hypertension (Table 3). Elevated serum uric acid levels (>7.0 mg/dL) were found in 39.3% of hypertensive individuals compared to 13.7% of normotensive individuals. Conversely, low serum uric acid levels (<5.5 mg/dL) were more frequent among normotensive participants (63.6%) compared to hypertensives (21.4%). The mean serum uric acid level was significantly higher in hypertensive participants (7.2 ± 1.0 mg/dL) than in normotensive individuals (5.8 ± 0.9 mg/dL) ($p < 0.001$).

Cardiovascular Events and Serum Uric Acid Levels

The occurrence of cardiovascular events is presented in Table 4. During the follow-up, 10% of participants experienced cardiovascular events, including acute coronary syndrome (4%), stroke (2%), and heart failure (2%). The mean serum uric acid levels were notably higher among those who developed cardiovascular events (ranging from 7.4 ± 0.8 mg/dL to 7.8 ± 0.5 mg/dL) compared to participants without any events (6.6 ± 1.1 mg/dL).

Table 1: Baseline Characteristics of Study Participants (n = 100)

Characteristic	Frequency (n)	Percentage (%)
Age Group (years)		
18–30	12	12%
31–45	26	26%
46–60	38	38%
>60	24	24%
Gender		
Male	58	58%
Female	42	42%
Hypertension Status		
Hypertensive	56	56%
Normotensive	44	44%

Table 2: Mean Clinical and Biochemical Parameters (n = 100)

Parameter	Mean ± SD
Systolic BP (mmHg)	138 ± 18
Diastolic BP (mmHg)	88 ± 12
Serum Uric Acid (mg/dL)	6.8 ± 1.2

Table 3: Association Between Serum Uric Acid Levels and Hypertension (n = 100)

Serum Uric Acid Levels	Hypertensive (n=56)	Normotensive (n=44)	p-value
<5.5 mg/dL	12 (21.4%)	28 (63.6%)	
5.5–7.0 mg/dL	22 (39.3%)	10 (22.7%)	
>7.0 mg/dL	22 (39.3%)	6 (13.7%)	**<0.001**
Mean Uric Acid (mg/dL)	**7.2 ± 1.0**	**5.8 ± 0.9**	**<0.001**

Table 4: Cardiovascular Events and Their Association with Serum Uric Acid Levels (n = 100)

Event	Number (n)	Percentage (%)	Mean Uric Acid (mg/dL)
No Event	90	90%	6.6 ± 1.1
Acute Coronary Syndrome	4	4%	7.4 ± 0.8
Stroke	2	2%	7.6 ± 0.7
Heart Failure	2	2%	7.8 ± 0.5

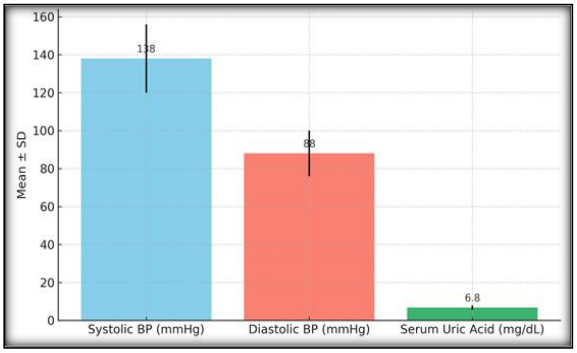

Figure 1: mean Clinical and Biochemical Parameters

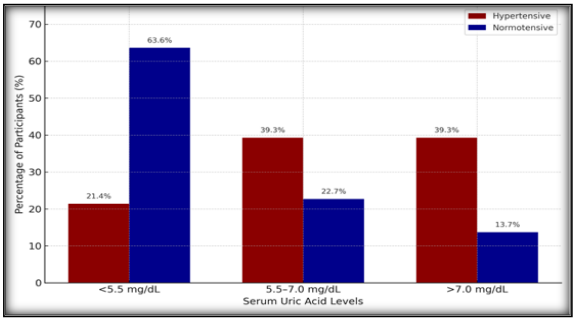

Figure 2: Association Between Serum Uric Acid Levels and Hypertension

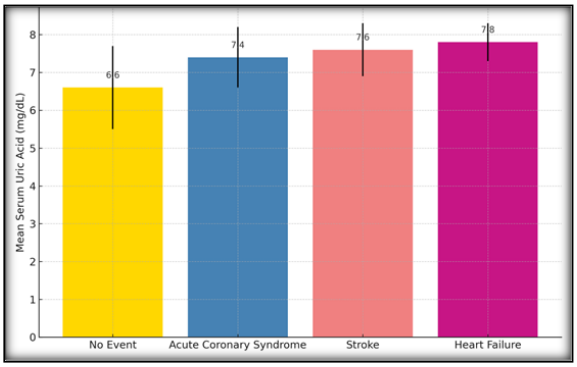

Figure 3: Cardiovascular Events and Their Association with Serum Uric Acid Levels

DISCUSSION

This prospective observational study established a significant association between elevated serum uric acid (SUA) levels and both hypertension and cardiovascular events in a tertiary care setting. Hypertensive individuals exhibited considerably higher mean uric acid levels compared to normotensives (7.2 ± 1.0 vs. 5.8 ± 0.9 mg/dL, $p < 0.001$), reinforcing the pathophysiological link between hyperuricemia and blood pressure dysregulation.

The present findings are in concordance with recent literature. Çağlı et al. demonstrated that increased SUA levels were positively associated with blood pressure variability in patients with newly diagnosed essential hypertension, suggesting that uric acid may influence not only mean blood pressure but also its dynamic fluctuations, which are known cardiovascular risk enhancers.[6] He et al., in a large cross-sectional study in China, also confirmed that higher SUA levels significantly correlate with increased prevalence of hypertension in the general population.[7] These data lend robust support to the observation in our cohort where 39.3% of hypertensives had SUA >7.0 mg/dL, compared to only 13.7% of normotensive individuals.

In addition to hypertension, our study observed that participants who experienced cardiovascular events (acute coronary syndrome, stroke, or heart failure) had significantly higher mean SUA levels (7.4–7.8 mg/dL) compared to those without events (6.6 mg/dL). Iliesiu et al. earlier emphasized the clinical significance of hyperuricemia in cardiovascular pathology, highlighting its role in endothelial injury, inflammation, and smooth muscle proliferation, all of which predispose to atherosclerosis and cardiovascular events.[8]

Sasaki et al. recently reported that SUA independently predicts the development of hypertension and cardiovascular outcomes in middle-aged and elderly individuals, further validating our findings in the Indian clinical setting.[9] Similarly, a retrospective cohort study by Luo et al. revealed that elevated SUA was associated with multiple cardiovascular risk factors, including dyslipidemia and metabolic syndrome, strengthening its role as an integrated cardiovascular biomarker.[10]

Yang et al. showed that Taiwanese patients with primary hypertension and elevated uric acid levels had significantly higher rates of cardiovascular morbidity, underscoring the consistency of this association across Asian populations.[11] Moreover, Yokokawa et al. found that higher SUA levels were linked to poor achievement of target blood pressure goals among Japanese community dwellers, indicating that uric acid may also impair antihypertensive treatment response.[12]

Collectively, these studies support our findings and reinforce the potential role of serum uric acid not only as a diagnostic biomarker but also as a therapeutic target in cardiovascular risk management. Given the simplicity, affordability, and accessibility of SUA measurement, incorporating it into routine cardiovascular risk assessment may offer added clinical value in both hypertensive and general populations.

However, this study has limitations. The sample size was modest, and the follow-up period was relatively short. Longitudinal studies with larger cohorts are warranted to better elucidate causality and long-term prognostic implications.

CONCLUSION

This prospective study highlights a significant association between elevated serum uric acid levels and both hypertension and cardiovascular events. Hypertensive individuals demonstrated notably higher uric acid levels compared to normotensive participants, suggesting a possible contributory role of hyperuricemia in the development and progression of hypertension. Furthermore, cardiovascular events such as acute coronary syndrome, stroke, and heart failure were more frequent among participants with elevated uric acid levels, indicating its potential as a predictive biomarker for cardiovascular risk. Routine evaluation of serum uric acid levels in clinical practice may aid in early identification of high-risk individuals, enabling timely interventions to reduce cardiovascular morbidity and improve long-term outcomes.

REFERENCES

1. Zhang SX, Yu YL, Tang ST, Lo K, Feng YQ, Chen JY. Association of serum uric acid levels with cardiovascular and all-cause mortality in hypertensive patients in China: a cohort study. Postgrad Med J. 2023 Jun 30;99(1173):708-714. doi: 10.1136/pmj-2021-141313. PMID: 37117041.
2. Yang Y, Zhang X, Jin Z, Zhao Q. Association of serum uric acid with mortality and cardiovascular outcomes in patients with hypertension: a meta-analysis. J Thromb Thrombolysis. 2021 Nov;52(4):1084-1093. doi: 10.1007/s11239-021-02453-z. Epub 2021 May 9. PMID: 33966143.
3. 3.D K, Swaminathan K, Velmurugan G, Ramakrishnan A, Alexander T, Raghupathy AK, Mohanraj S. Association between serum uric acid levels and cardiovascular risk factors among adults in India. Nutr Metab Cardiovasc Dis. 2023

Jul;33(7):1330-1338. doi: 10.1016/j.numecd.2023.05.003. Epub 2023 May 5. PMID: 37263912.
4. Qin L, Yang Z, Gu H, Lu S, Shi Q, Xing Y, Li X, Li R, Ning G, Su Q. Association between serum uric acid levels and cardiovascular disease in middle-aged and elderly Chinese individuals. BMC Cardiovasc Disord. 2014 Feb 25;14:26. doi: 10.1186/1471-2261-14-26. PMID: 24568132; PMCID: PMC3974065.
5. Navaneethan SD, Beddhu S. Associations of serum uric acid with cardiovascular events and mortality in moderate chronic kidney disease. Nephrol Dial Transplant. 2009 Apr;24(4):1260-6. doi: 10.1093/ndt/gfn621. Epub 2008 Nov 25. PMID: 19033255; PMCID: PMC2721426.
6. Çağlı K, Turak O, Canpolat U, Özcan F, Tok D, Mendi MA, Öksüz F, Siriopol D, Veisa G, Covic A, Kanbay M. Association of Serum Uric Acid Level With Blood Pressure Variability in Newly Diagnosed Essential Hypertension. J Clin Hypertens (Greenwich). 2015 Dec;17(12):929-35. doi: 10.1111/jch.12641. Epub 2015 Aug 7. PMID: 26252718; PMCID: PMC8031696.
7. He Y, Chen D, Xu JP, Jin J, Wang J, Geng C, He YM. Association between Serum Uric Acid and Hypertension in a Large Cross-Section Study in a Chinese Population. J Cardiovasc Dev Dis. 2022 Oct 10;9(10):346. doi: 10.3390/jcdd9100346. PMID: 36286298; PMCID: PMC9604751.
8. Iliesiu A, Campeanu A, Dusceac D. Serum uric acid and cardiovascular disease. Maedica (Bucur). 2010 Jul;5(3):186-92. PMID: 21977151; PMCID: PMC3177556.
9. Sasaki N, Ueno Y, Ozono R, Yoshimura K, Nakano Y, Higashi Y. Association of serum uric acid levels with blood pressure and the incidence of hypertension in the middle-aged and elderly populations. J Hypertens. 2024 Feb 1;42(2):292-300. doi: 10.1097/HJH.0000000000003597. Epub 2023 Oct 11. PMID: 37851003.
10. Luo Y, Wu Q, Meng R, Lian F, Jiang C, Hu M, Wang Y, Ma H. Associations of serum uric acid with cardiovascular disease risk factors: a retrospective cohort study in southeastern China. BMJ Open. 2023 Sep 27;13(9):e073930. doi: 10.1136/bmjopen-2023-073930. PMID: 37758669; PMCID: PMC10537982.
11. Yang TY, Fang CY, Chen JS, Po HL, Chou LP, Chiang CY, Ueng KC. Association of Serum Uric Acid with Cardiovascular Disease in Taiwanese Patients with Primary Hypertension. Acta Cardiol Sin. 2015 Jan;31(1):42-51. doi: 10.6515/acs20140120a. PMID: 27122845; PMCID: PMC4804912.
12. Yokokawa H, Suzuki M, Aoki N, Fukuda H, Sato Y, Hisaoka T, Naito T. Association between serum uric acid levels and achievement of target blood pressure among Japanese community residents with hypertension. J Clin Hypertens (Greenwich). 2023 Mar;25(3):295-303. doi: 10.1111/jch.14644. Epub 2023 Feb 15. PMID: 36794380; PMCID: PMC9994162.