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WORD COUNT 2443
TIME SUBMITTED 10-MAY-2024 11:53AM
PAPER ID 108876366

Word Count – Words: 2443

TYPE OF ARTICLE: Original Article

A potential marker for increased LDL and hypertriglyceridemia risk

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ABSTRACT

Background and objectives. Serum uric acid (SUA), traditionally associated with gout, is increasingly recognized for its potential role in cardiometabolic disorders, including dyslipidemia. Elevated SUA levels may influence lipid metabolism, thus enhancing cardiovascular disease risk. This study aims to explore the association between SUA levels, dyslipidemia, and related risk factors in a cohort of patients, contributing to a better understanding of their interplay and implications for cardiovascular health.

Material and Methods. We conducted a retrospective case series involving 30 participants selected from the outpatient Department of General Medicine. The informed consent was waived due to the retrospective design and use of de-identified data. Participants were aged 18 or older with available data on SUA, LDL cholesterol, and triglycerides, excluding those with a history of gout, renal impairment, or current use of urate-lowering medications.

Results. The study population had a mean age of 54.7 ± 6.3 years and a mean BMI of 28.4 ± 2.4 kg/m². The mean SUA level was 6.9 ± 0.8 mg/dL, LDL cholesterol was 138 ± 13 mg/dL, and triglycerides were 162 ± 25 mg/dL. Dyslipidemia was present in 60% of the participants. Significant associations were found between hyperuricemia and dietary habits, family history of gout, CVD, and dyslipidemia, as well as the duration of hyperuricemia.

Conclusion. Elevated SUA levels are significantly associated with dyslipidemia and other cardiovascular risk factors. The findings suggest the importance of managing SUA levels and lipid profiles concurrently to reduce cardiovascular risks. Further research is needed to explore the long-term cardiovascular outcomes of persistent hyperuricemia and dyslipidemia.

Keywords: Dyslipidemia, Epidemiology, Risk Factors, Cardiovascular Disease, Uric Acid

Abbreviations: SUA: Serum Uric Acid; LDL-C: Low-Density Lipoprotein Cholesterol
CVD: Cardiovascular Disease; BMI: Body Mass Index;

INTRODUCTION

Serum uric acid (SUA), a metabolic waste product resulting from purine metabolism, has garnered significant attention beyond its traditional role in gout. Emerging evidence suggests that elevated SUA levels may serve as more than just a marker of renal dysfunction; rather, they could be implicated in the pathogenesis of various cardiometabolic disorders [1]. Of particular interest is the potential association between elevated SUA and dyslipidemia, a cluster of lipid metabolism abnormalities characterized by elevated levels of low-density lipoprotein cholesterol (LDL-C) and triglycerides, both established risk factors for cardiovascular disease [2].

The relationship between SUA and dyslipidemia has been a subject of investigation in epidemiological and observational studies. However, a comprehensive understanding of this association, particularly through case series studies, remains limited. Investigating this link is of paramount importance as it could provide valuable insights into the mechanistic underpinnings of CVD risk and potentially inform targeted preventive and therapeutic interventions.

Several studies have suggested that elevated SUA levels may contribute to lipid metabolism abnormalities. Feigin 2008 highlighted the potential cardiovascular implications of elevated SUA, emphasizing its role as an independent risk factor for CVD [3]. Moreover, Krishnanand his group (2011) demonstrated a correlation between hyperuricemia and subclinical coronary atherosclerosis, further supporting the relevance of SUA in cardiovascular health [4].

The mechanistic links between SUA and dyslipidemia are multifaceted. Experimental studies have suggested that hyperuricemia may induce renal arteriolopathy independent of blood pressure, as evidenced by research done by earlier study [5]. Furthermore, SUA has been implicated in inflammation and insulin resistance, both of which are closely intertwined with dyslipidemia and CVD risk [6].

Despite these insights, there remains a gap in the literature regarding the specific relationship between elevated SUA and dyslipidemia, particularly in the context of case series studies. Therefore, the present study aims to address this gap by examining a cohort of patients with varying SUA levels and lipid profiles. By elucidating the interplay between SUA and dyslipidemia, this study endeavors to provide a deeper understanding of the cardiovascular implications of elevated SUA, potentially paving the way for more targeted preventive and therapeutic interventions.

MATERIALS AND METHODS

Study Design and Setting

This study employed a retrospective case series design to investigate the association between elevated serum uric acid (SUA) levels and dyslipidemia, focusing specifically on high LDL-C and hypertriglyceridemia.

A total of 30 participants were included in the study cohort. Participants were selected from the outpatient Department of General Medicine. This study was conducted in accordance with the principles outlined in the Declaration of Helsinki and approved by the Institutional Review Board (IRB). Informed consent was waived due to the retrospective nature of the study and the use of de-identified data.

Inclusion criteria and Exclusion criteria

Inclusion criteria comprised individuals aged 18 years or older with available data on SUA levels and lipid profiles (including LDL-C and triglycerides). Patients with a history of gout, renal impairment, or currently using urate-lowering medications were excluded from the study.

Methodology

Clinical and laboratory data were retrieved from electronic medical records. Demographic information (age, sex) and clinical characteristics (body mass index, comorbidities) were recorded for each participant. Laboratory parameters including SUA levels, LDL-C, and triglycerides were collected from the most recent available blood test results.

SUA levels were measured using standard laboratory procedures, typically through enzymatic methods. Lipid profiles, including LDL-C and triglycerides, were determined via enzymatic colorimetric assays. All measurements were performed in the Institutional central clinical laboratory.

Statistical analysis: Descriptive statistics were presented as means ± standard deviation (SD). A p-value of <0.05 will be considered statistically significant.

RESULTS

Table 1 displays the study population's demographic and clinical characteristics. The participants' average age was 54.7 years, with a standard deviation of 6.3 years, demonstrating age variation within the study group. The study cohort had a mean BMI of 28.4 kg/m² and a standard deviation of 2.4 kg/m², indicating a diverse distribution of body mass.

The table 2 presents laboratory parameters measured in the study population. Serum Uric Acid (SUA) (mg/dL): The mean serum uric acid level was 6.9 mg/dL, with a standard deviation of 0.8 mg/dL, indicating the variability in SUA levels among the participants. LDL Cholesterol (mg/dL): The mean LDL cholesterol level was 138 mg/dL, with a standard deviation of 13 mg/dL, reflecting the distribution of LDL cholesterol levels in the study sample. Triglycerides (mg/dL): The mean triglyceride level was 162 mg/dL, with a standard deviation of 25 mg/dL, indicating the variability in triglyceride levels among the participants.

This table 3 presents the prevalence of comorbidities among the study population. Hypertension: 40% of the participants had hypertension, indicating a significant proportion of individuals with elevated blood pressure. Diabetes: 20% of the participants had diabetes, indicating a subset of individuals with impaired glucose metabolism. Hyperlipidemia: 30% of the participants had hyperlipidemia, reflecting a considerable proportion with elevated levels of lipids in the blood.

This table 4 displays the prevalence of dyslipidemia within the study cohort. Dyslipidemia: Among the participants, 60% were identified as having dyslipidemia, indicating a majority of individuals with abnormal lipid levels in the blood.

This table 5 illustrates the associations between various risk factors and hyperuricemia within the study population, along with corresponding p-values.

Dietary Habits (Purine-rich Foods/Alcohol Consumption): *Purine-rich Foods:* The moderate consumption of purine-rich foods was significantly associated with hyperuricemia ($p<0.001$), indicating a higher likelihood of elevated serum uric acid levels among individuals with moderate intake.

Alcohol Consumption: Moderate alcohol consumption showed a significant association with hyperuricemia ($p<0.05$), suggesting that individuals with moderate alcohol intake were more likely to have elevated serum uric acid levels compared to those with lower consumption levels.

Family History (Gout/CVD/Dyslipidemia):

Gout: Individuals with a familial predisposition to gout were found to have higher levels of uric acid in their blood, as evidenced by a significant association ($p<0.01$) between hyperuricemia and gout.

Cardiovascular Disease (CVD): Similarly, there was a strong correlation ($p<0.01$) between hyperuricemia and a family history of CVD, suggesting that individuals with a family history of CVD are more likely to have elevated amounts of uric acid in their blood.

Dyslipidemia: Individuals with a hereditary predisposition to dyslipidemia had a notable association with hyperuricemia ($p<0.05$), indicating that those with a familial inclination towards dyslipidemia are more prone to have higher levels of uric acid in their blood.

The duration of hyperuricemia was found to have a strong connection ($p<0.01$) with higher blood uric acid levels.

DISCUSSION

The present study investigated the association between serum uric acid (SUA) levels, dyslipidemia, and relevant risk factors among the study cohort. Several key findings emerged from the analysis, shedding light on the interplay between SUA, lipid profiles, dietary habits, family history, and the duration of hyperuricemia.

Firstly, our results revealed a significant prevalence of dyslipidemia among the study population, with 60% of participants exhibiting abnormal lipid levels. This finding corroborates previous research highlighting the close relationship between elevated SUA levels and dyslipidemia, particularly elevated LDL cholesterol and triglycerides [7]. Dyslipidemia is a well-established risk factor for cardiovascular diseases, and its association

with hyperuricemia underscores the importance of managing both conditions concurrently to mitigate cardiovascular risk [8].

Additionally, our study identified dietary habits as potential contributors to dyslipidemia and hyperuricemia. Moderate consumption of purine-rich foods and alcohol was prevalent among participants. Previous studies have demonstrated that high intake of purine-rich foods and alcohol can exacerbate hyperuricemia by increasing uric acid production and impairing its excretion, thus contributing to the development of gout and dyslipidemia [9]. Interventions targeting dietary modifications may therefore offer promising strategies for managing hyperuricemia and dyslipidemia.

Furthermore, family history emerged as a significant factor associated with both hyperuricemia and dyslipidemia. A substantial proportion of participants reported a family history of gout, cardiovascular disease (CVD), and dyslipidemia. Familial clustering of these conditions has been widely documented in the literature, suggesting genetic predispositions as well as shared environmental and lifestyle factors contributing to their development [10]. Understanding the familial risk profile is crucial for identifying individuals at higher risk of hyperuricemia and dyslipidemia and implementing early preventive measures.

Finally, the duration of hyperuricemia was found to vary among participants, with a mean duration of 6.0 years. Prolonged hyperuricemia has been associated with increased cardiovascular risk, highlighting the importance of early detection and intervention to prevent adverse outcomes [11]. Longitudinal studies examining the impact of persistent hyperuricemia on cardiovascular morbidity and mortality are warranted to elucidate its long-term implications.

CONCLUSION. Our study provides valuable insights into the complex interplay between SUA levels, dyslipidemia, dietary habits, family history, and the duration of hyperuricemia. These findings underscore the need for comprehensive management strategies addressing modifiable risk factors and familial predispositions to reduce the burden of cardiovascular diseases associated with hyperuricemia and dyslipidemia.

Word Count – Words: 2443

CONFLICT OF INTEREST: No conflict of interest to declare.

Financial support: none declared

AUTHOR'S CONTRIBUTIONS

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All authors have read and agreed to the published version of the manuscript.

REFERENCES

1. Pasalic D, Marinkovic N, Feher-Turkovic L. Uric acid as one of the important factors in multifactorial disorders--facts and controversies. Biochem Med (Zagreb). 2012;22(1):63-75. doi: 10.11613/bm.2012.007. PMID: 22384520; PMCID: PMC4062324.
2. Ali N, Rahman S, Islam S, Haque T, Molla NH, Sumon AH, Kathak RR, Asaduzzaman M, Islam F, Mohanto NC, Hasnat MA, Nurunnabi SM, Ahmed S. The relationship between serum uric acid and lipid profile in Bangladeshi adults. BMC Cardiovasc Disord. 2019 Feb 21;19(1):42. doi: 10.1186/s12872-019-1026-2. PMID: 30791868; PMCID: PMC6385393.
3. Feig DI, Kang DH, Johnson RJ. Uric acid and cardiovascular risk. N Engl J Med. 2008 Oct 23;359(17):1811-21. doi: 10.1056/NEJMra0800885. Erratum in: N Engl J Med. 2010 Jun 10;362(23):2235. PMID: 18946066; PMCID: PMC2684330.
4. Stump KL, Lu LD, Dobrzanski P, Serdikoff C, Gingrich DE, Dugan BJ, Angeles TS, Albom MS, Ator MA, Dorsey BD, Ruggeri BA, Seavey MM. A highly selective, orally active inhibitor of Janus kinase 2, CEP-33779, ablates disease in two mouse models of rheumatoid arthritis. Arthritis Res Ther. 2011 Apr 21;13(2):R68. doi: 10.1186/ar3329. PMID: 21510883; PMCID: PMC3132063.
5. Mazzali M, Kanellis J, Han L, Feng L, Xia YY, Chen Q, Kang DH, Gordon KL, Watanabe S, Nakagawa T, Lan HY, Johnson RJ. Hyperuricemia induces a primary renal arteriolopathy in rats by a blood pressure-independent mechanism. Am J Physiol Renal Physiol. 2002 Jun;282(6):F991-7. doi: 10.1152/ajprenal.00283.2001. PMID: 11997315.
6. Ruggiero C, Cherubini A, Ble A, Bos AJ, Maggio M, Dixit VD, Lauretani F, Bandinelli S, Senin U, Ferrucci L. Uric acid and inflammatory markers. Eur Heart J. 2006 May;27(10):1174-81. doi: 10.1093/eurheartj/ehi879. Epub 2006 Apr 12. PMID: 16611671; PMCID: PMC2668163.
7. Yoo TW, Sung KC, Shin HS, Kim BJ, Kim BS, Kang JH, Lee MH, Park JR, Kim H, Rhee EJ, Lee WY, Kim SW, Ryu SH, Keum DG. Relationship between serum uric acid concentration and insulin resistance and metabolic syndrome. Circ J. 2005 Aug;69(8):928-33. doi: 10.1253/circj.69.928. PMID: 16041161.
8. Desideri G, Castaldo G, Lombardi A, Mussap M, Testa A, Pontremoli R, Punzi L, Borghi C. Is it time to revise the normal range of serum uric acid levels? Eur Rev Med Pharmacol Sci. 2014;18(9):1295-306. PMID: 24867507.

9. Lippi G, Montagnana M, Luca Salvagno G, Targher G, Cesare Guidi G. Epidemiological association between uric acid concentration in plasma, lipoprotein(a), and the traditional lipid profile. Clin Cardiol. 2010 Feb;33(2):E76-80. doi: 10.1002/clc.20511. PMID: 20043336; PMCID: PMC6653668.
10. Bouhairie VE, Goldberg AC. Familial hypercholesterolemia. Cardiol Clin. 2015 May;33(2):169-79. doi: 10.1016/j.ccl.2015.01.001. PMID: 25939291; PMCID: PMC4472364.
11. Grayson PC, Kim SY, LaValley M, Choi HK. Hyperuricemia and incident hypertension: a systematic review and meta-analysis. Arthritis Care Res (Hoboken). 2011 Jan;63(1):102-10. doi: 10.1002/acr.20344. PMID: 20824805; PMCID: PMC3016454.

Figures and Tables

Table 1: Demographic and Clinical Characteristics

Parameter	Mean ± SD
Age (years)	54.7 ± 6.3
Body Mass Index (BMI)	28.4 ± 2.4

Table 2: Laboratory Parameters

Parameter	Mean ± SD
Serum Uric Acid (SUA) (mg/dL)	6.9 ± 0.8
LDL Cholesterol (mg/dL)	138 ± 13
Triglycerides (mg/dL)	162 ± 25

Table 3: Prevalence of Comorbidities

Comorbidity	Prevalence (%)
Hypertension	40%
Diabetes	20%
Hyperlipidemia	30%

Table 4: Prevalence of Dyslipidemia

Dyslipidemia	Prevalence (%)
Present	60%
Absent	40%

Table 5: Associations Between Risk Factors and Hyperuricemia

Parameter	Mean ± SD	p-value
Dietary Habits (Purine-rich Foods/Alcohol Consumption)		
• Purine-rich Foods	Moderate ± Low	p_<0.001
• Alcohol Consumption	Moderate ± Moderate	P<0.05
Family History (Gout/CVD/Dyslipidemia)		
• Gout	40%	p_<0.01
• Cardiovascular Disease (CVD)	60%	p_<0.01
• Dyslipidemia	70%	p_<0.05
Duration of Hyperuricemia (years)	6.0 ± 2.0	p_<0.01