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(RESEARCH ARTICLE)

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A hospital-based investigation into the relationship between serum uric acid levels and estimated glomerular filtration rate in patients with chronic kidney disease

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Abstract

Background: Chronic kidney disease (CKD) includes a range of pathophysiological processes linked to impaired kidney function and a gradual reduction in glomerular filtration rate. CKD has emerged as a global public health concern, associated with heightened risks of cardiovascular complications and decreased quality of life. Elevated serum uric acid levels are frequently observed in CKD, and this study aimed to investigate the relationship between serum uric acid levels and estimated glomerular filtration rate (eGFR) in patients with CKD.

Methods: Uric acid and creatinine serum levels were assessed in 151 patients at the Department of Medicine and Nephrology of Gauhati Medical College and Hospital in Guwahati. A comprehensive medical history and clinical examination were conducted, and patients underwent required diagnostic tests.

Results: In this study Uric acid levels were negatively associated with eGFR. Higher the serum uric acids levels lower the GFR values.

Conclusions: Serum uric acid level is negatively associated with renal function, as assessed by eGFR.

Keywords: Chronic Kidney Disease; Estimated Glomerular Filtration Rate; Uric Acid; Hyperuricemia

1. Introduction

Chronic Kidney Disease (CKD) is characterized by kidney damage, indicated by abnormal albumin excretion or a reduction in kidney function, as measured by either the glomerular filtration rate (GFR) or its estimation, lasting for over three months. The presence of additional co-morbidities increases the risk of complications and the likelihood of advancing to end-stage renal disease, which necessitates renal replacement therapy. Timely intervention is more likely to mitigate severe consequences of CKD and decelerate its progression. Uric acid is the end product of purine metabolism, primarily excreted by the kidneys and, to a lesser extent, by the intestines. Consequently, patients with a decreased glomerular filtration rate (GFR) often exhibit elevated serum uric acid levels. Recent studies suggest that uric acid may play a direct role in the pathophysiology of chronic kidney disease (CKD) or could be a result of CKD itself. High levels of uric acid are associated with endothelial dysfunction, proliferation of vascular smooth muscle cells, increased synthesis of IL-6, and reduced nitric oxide production, all of which may exacerbate the progression of chronic kidney disease. Additionally, some individuals with elevated uric acid levels may experience joint pain and stiffness, leading to limited mobility in the affected joints. This research primarily examined the relationship between Serum Uric Acid Levels and Glomerular Filtration Rate (GFR). The aim was to investigate the correlation between these two variables.

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2. Materials and Methods

Our study was a single centre, observational study in the department of Medicine and Nephrology of Gauhati Medical College and Hospital, Guwahati for a period of one year from 1st July 2016 to 30th June 2017.

The study was approved by the Institutional Ethics Committee of Gauhati Medical College and Hospital, Guwahati. Informed consent was taken from every patient included in the study.

2.1. Inclusion criteria

All the patients above 12 years of age with confirmed chronic kidney disease and those diagnosed with CKD following evaluation between 1st July 2016 to 30th June 2017 were included in this study.

2.2. Exclusion criteria

A patient with a known case of uric acid nephropathy, Congenital kidney disease like polycystic kidney disease, Obstructive uropathy, Patient on renal replacement therapy (Haemodialysis, peritoneal dialysis and renal transplantation) and Acute kidney injury were excluded from this study after performing relevant investigations

2.3. Statistical methods

Data obtained in the study were analyzed statistically on the "SPSS-16.0" software package as per standard methods (Snedecor and Cochran, 1995).

3. Results

The study shows that the mean uric acid levels in CKD stage 2, 3, 4 and 5 were (4.8±2.22) mg/dl, (5.13±2.65) mg/dl, (7.8±2.79) mg/dl and (9.03±2.81) mg/dl respectively. Serum uric acid level more than or equal to 8mg/dl were seen in 15 patients in stage 4 CKD and 67 patients in CKD stage 5.

Table 1 Mean serum uric acid levels according to CKD staging

CKD stage	Mean serum uric acid levels (mg/dL)
I	
II	4.8±2.2
III	5.1±2.6
IV	7.8±2.8
V	9.0±2.8

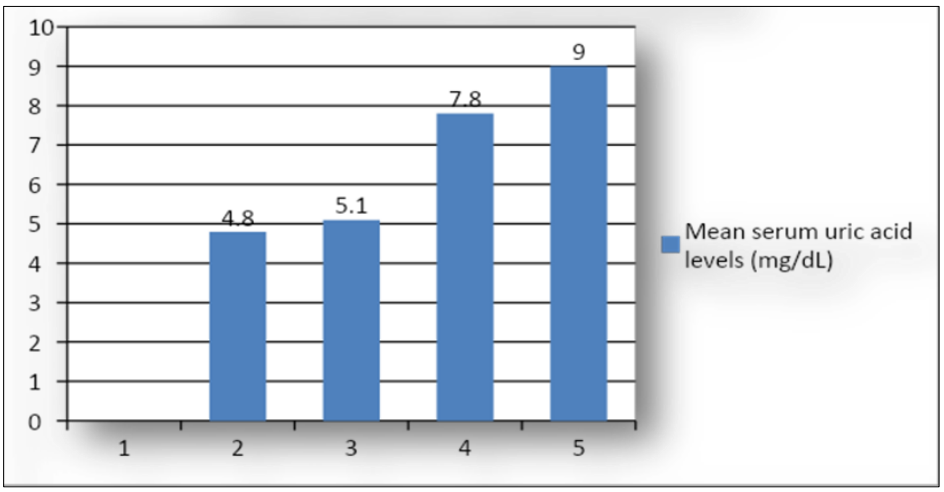

Figure 1 Mean serum uric acid levels (mg/dL)

Table 2 Serum uric acid levels according to GFR

CKD Stage	eGFR	<4	4-4.9	5-5.9	6-6.9	7-7.9	≥8
1	≥90	0	0	0	0	0	0
2	60-89	1	0	0	1	0	0
3	30-59	2	3	3	1	1	0
4	14-29	1	4	7	5	6	15
5	15	1	3	2	15	13	67

The difference in serum uric levels between stage 2 and stage 3 (p=0.882) and between stage 2 and stage 4 (p=0.1464) are statistically not significant. However, the difference in serum uric acid levels between stage 2 and 5 (p=0.0378), between stage 3 and 4 (p=0.0087), between stage 3 and 5(p=0.0001) and between stage 4 and 5(p=0.0272) are statistically very significant.

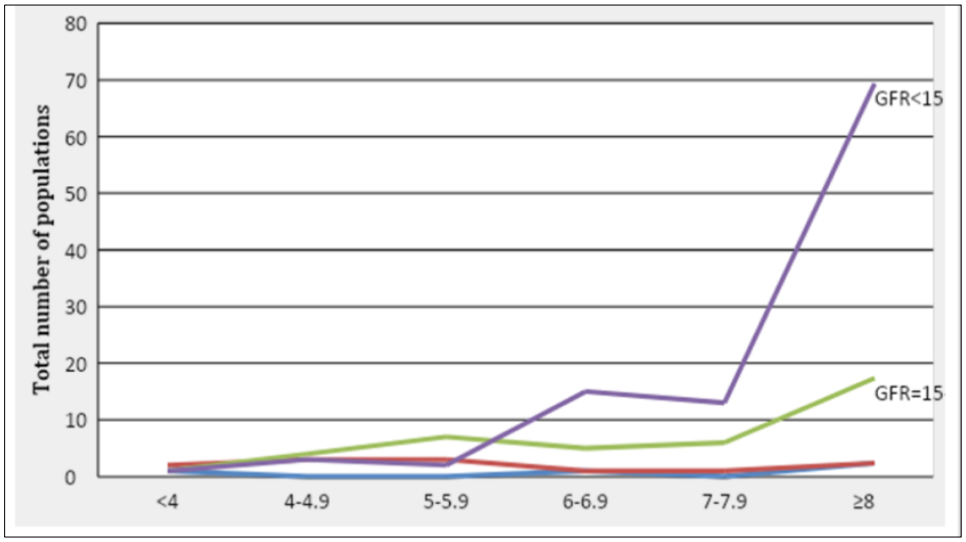

Figure 2 Correlation between eGFR and serum uric acid levels

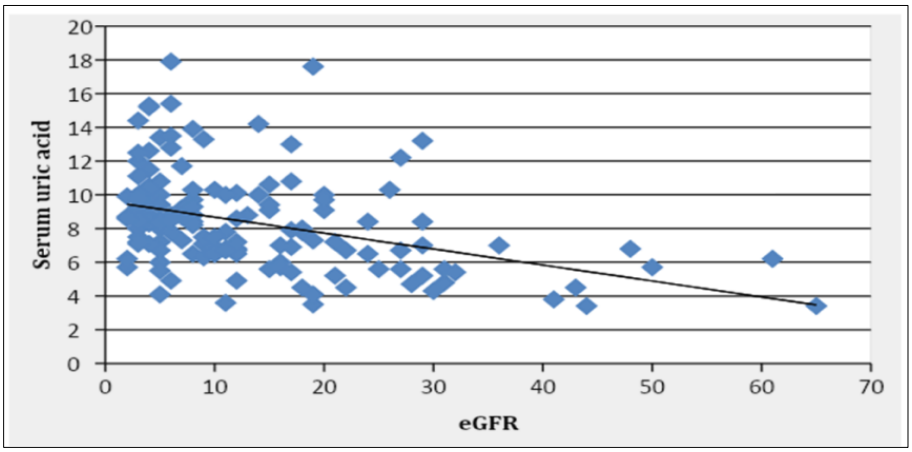

Figure 3 Correlations between baseline serum uric acid and eGFR

As shown in the scatter diagram there is a negative correlation between serum uric acid levels and eGFR values (r= -0.3957, p= <0.0001) (figure.2) So, higher the serum uric acids levels lower the GFR values.

4. Discussion

The current research indicates a significant negative correlation between serum uric acid levels and estimated glomerular filtration rate (eGFR) in chronic kidney disease (CKD). Specifically, as serum uric acid levels increase, eGFR values tend to decrease. This finding aligns with the work of Chonchoi M et al. (2007), which established that serum uric acid exhibits an inverse relationship with eGFR and serves as an independent risk factor for CKD. Furthermore, individuals with elevated serum uric acid levels are more likely to present with higher serum creatinine values.

Similar observations were made by Chonchol M. et al. (2007), who reported that increased serum uric acid levels correlate with reduced eGFR in CKD patients. The study also revealed a more pronounced decline in eGFR corresponding to rising serum uric acid levels, with declines of 7%, 14%, 12%, 25%, and 42% at serum uric acid levels of (≤4.41) mg/dl, (4.41-5.20) mg/dl, (5.21-5.90) mg/dl, (5.91-6.90) mg/dl, and (>6.90) mg/dl, respectively.

In the present study, higher serum uric acid levels were similarly associated with lower eGFR values. The average serum uric acid levels for CKD stages 2, 3, 4, and 5 were (4.8±2.22) mg/dl, (5.13±2.65) mg/dl, (7.8±2.79) mg/dl, and (9.03±2.81) mg/dl, respectively. Notably, serum uric acid levels of 8 mg/dl or higher were observed in 15 patients at stage 4 CKD and 67 patients at stage 5 CKD. The differences in serum uric acid levels between stages 2 and 3 (p=0.882) and between stages 2 and 4 (p=0.1464) were not statistically significant.

However, significant differences were noted between stages 2 and 5 (p=0.0378), stages 3 and 4 (p=0.0087), stages 3 and 5 (p=0.0001), and stages 4 and 5 (p=0.0272). The results of this study are consistent with findings from Mok Y. et al. (2012), which indicated that higher serum uric acid levels independently elevate the risk of CKD, with renal dysfunction severity increasing alongside serum uric acid levels. In that prospective study, serum uric acid levels exceeding 6.6 mg/dl in men and 4.6 mg/dl in women were linked to a significant increase in risk.

Summary

The key findings of the study are summarized as follows. Conducted over a one-year period from July 1, 2016, to June 30, 2017, the research was performed in the departments of Medicine and Nephrology, involving an analysis of 151 patients aged over 15 years with chronic kidney disease (CKD). The results indicated that the mean uric acid levels for CKD stages 2, 3, 4, and 5 were (4.8±2.22) mg/dl, (5.13±2.65) mg/dl, (7.8±2.79) mg/dl, and (9.03±2.81) mg/dl, respectively. It was observed that higher uric acid levels corresponded with more advanced stages of CKD. Additionally, a negative correlation was found between serum uric acid levels and estimated glomerular filtration rate (eGFR) values (r= -0.3957, p= <0.0001), indicating that increased serum uric acid levels are associated with decreased GFR values.

5. Conclusion

Based on above findings showed that serum uric acid levels are negatively associated with eGFR under conditions of reduced renal function, Further studies are required to investigate the impact on renal function and long-term survival in this very-high-risk population of active interventions to decrease levels of uric acid.

Compliance with ethical standards

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Disclosure of conflict of interest

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Statement of ethical approval

The study was approved by the Institutional Ethics Committee of Gauhati Medical College and Hospital, Guwahati.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Chonchol, M., Shlipak, M. G., Katz, R., Sarnak, M. J., Newman, A. B., Siscovick, D. S.,Fried, L. F. (2007). Relationship of Uric Acid With Progression of Kidney Disease. American Journal of Kidney Diseases, 50(2), 239–247.

[2] Mok, Y., Lee, S. J., Kim, M. S., Cui, W., Moon, Y. M., and Jee, S. H. (2012). Serum uric acid and chronic kidney disease: the Severance cohort study. Nephrology Dialysis Transplantation, 27(5), 1831–1835. doi:10.1093/ndt/gfr530.

[3] Snedecor, G.W. and Cochran, W.G. (1995). In: Stastistical Methods. 8th edn., Oxford and IBH Pub. Co., New Delhi.

[4] Takae, K., Nagata, M., Hata, J., Mukai, N., Hirakawa, Y., Yoshida, D., Ninomiya, T. (2017). Serum Uric Acid as a Risk Factor for Chronic Kidney Disease in a Japanese Community. The Hisayama Study Circulation Journal, 80(8), 1857-1862. doi:10.1253/circj.cj-16-0030.

[5] Toyama, T., Furuichi, K., Shimizu, M., Hara, A., Iwata, Y., Sakai, N.(2015). Relationship between Serum Uric Acid Levels and Chronic Kidney Disease in a Japanese Cohort with Normal or Mildly Reduced Kidney Function. PLoS ONE, 10(9), e0137449. http://doi.org/10.1371/journal.pone.0137449.