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ASSOCIATION OF SERUM URIC ACID LEVEL AND ESTIMATED GLOMERULAR FILTRATION RATE IN CHRONIC KIDNEY DISEASE PATIENTS

Nephrology

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ABSTRACT

BACKGROUND: Chronic kidney disease (CKD) is defined as irreversible loss of kidney function or estimated glomerular filtration rate (eGFR) less than 60 ml/min/1.73m^2 for a period of 3 months or more. Uric acid (UA) is an end product of purine metabolism which is widely recognized as an independent risk factor of cardiovascular disease.

AIMS: This case control study was plan to assessed the correlation of serum Uric Acid with estimated Glomerular Filtration Rate (eGFR) in CKD patients.

METHODOLOGY: In the study 50 diagnosed patients of CKD (stage 4 and 5), age between 20 to 60 years were enrolled. 50 age and sex matched healthy subjects constituted the control group. Serum Urea, Creatinine and uric acid were estimated for all the enrolled subjects. eGFR was calculated by Cockeroft and Gault formula. Results were compared between CKD patients and control group by applying suitable statistical test.

RESULT: Mean eGFR was significantly lower in CKD group (10.28± 4.18 ml/min/1.73m2, p <0.0001) as compared to healthy subjects. Mean serum uric acid were significantly higher in CKD patients (8.02 ± 1.84 mg/dl, p <0.0001) as compared to healthy subjects. A significant negative correlation was observed between Serum uric acid and eGFR on applying Spearmanns's correlation (r = -0.463, p <0.0001).

CONCLUSION: High level of serum uric acid was found to be associated with significant fall in eGFR. Finding of the study suggest a strong association of hyperuricemia with progression of CKD. Therefore, uric acid can be considered as an independent risk factor for development of end stage renal disease (ESRD).

KEYWORDS

Chronic Kidney Disease, Uric Acid, eGFR,

INTRODUCTION

Chronic kidney disease (CKD) is defined as irreversible loss of kidney function or estimated glomerular filtration rate (eGFR) less than 60 ml/min/1.73m^2 for a period of 3 months or more.[1] Uric acid is an end product of purine metabolism which is widely recognized as an independent risk factor of cardiovascular disease.[2-4] In recent years, it has been suggested as a contributory risk factor for progression of chronic kidney disease (CKD).[5] According to WHO, CKD is the 12th major cause of death and the 17th cause of disability world-wide.[6] Hyperuricemia can induce glomerular hypertension due to development of arteriolosclerosis, glomerular injury and tubular fibrosis.[7]

Diabetes and hypertension are major causes of the end-stage renal failure. The largest percentages of end-stage renal disease in Asia due to diabetes: 42% Pakistan, 35% Taiwan, 25% Philippines, 37% in Japan. The largest number of people with diabetes belong from India, projected figure of 57.2 million cases in 2025.[8]

The present study was planned to assess the correlation of serum Uric Acid with estimated Glomerular Filtration Rate (eGFR) in CKD patients.

MATERIAL AND METHODOLOGY

This is case control analytical study carried out on 50 diagnosed patients of CKD (stage 4 and 5), visiting the outpatient department of Nephrology at Mahatma Gandhi Medical College & Hospital, Jaipur. The study was conducted after approval from the Institutional Ethics Committee and written consent from all participants.

INCLUSION CRITERIA

Diagnosed cases of CKD n= 50 (stage 4 and 5) as per the guidelines of National Kidney Foundation [9], age between 20 to 60 years.
According to the above criteria
Stage 4 CKD is defined as GFR 15 – 29 ml/min/1.73m^2 and
Stage 5 CKD is < 15 ml/min/1.73 m^2.
Age and sex-matched healthy subjects n=50 constituted the control group.

EXCLUSION CRITERIA

- Patients suffering from excessive cell destruction (e.g., following chemotherapy).
- Patients with congestive heart failure and myocardial infarction.
- Patients having history of gout and/ Hyperuricemia.

Blood samples were collected using standard aseptic technique and analyzed for Serum urea, creatinine and uric acid on VITROS 5600.

The Glomerular filtration rate (eGFR) was calculated by using Cockeroft and Gault formula.

For Males = [(140-age in years)x(weight in kg)] ÷ 72 X serum creatinine
For Females = 0.85 X [(140-age in years)x(weight in kg)]÷ 72 X serum creatinine

Results obtained were presented as mean ± SD for the case and control groups and compared statistically using SPSS software. Applying Spearmanns's correlation for serum uric acid and eGFR.

RESULT:

Mean blood urea and serum creatinine were higher in CKD patients as compared to healthy subjects. Mean serum uric acid was significantly higher in CKD patients (8.02 ± 1.84 mg/dl, p <0.0001) as compared to healthy subjects. Mean eGFR was significantly lower in CKD group (10.28± 4.18 ml/min/1.73m^2, p <0.0001) as compared to healthy subjects. (Table 1)

A significant negative correlation was observed between Serum uric acid and eGFR on applying Spearmanns's correlation (r = -0.463, p <0.0001).(Table 2, Fig 1)

Table 1: Distribution of variables between CKD patients and Control group

Variables	CKD patients	Control	t-value	P-value
S. Urea (mg/dl)	107.66± 55.0	24.62±4.16	10.65	<0.0001
S.Creatinine (mg/dl)	8.23± 2.30	0.69±0.14	23.14	<0.0001

S. Uric acid (mg/dl)	8.02 ± 1.84	4.68±1.54	9.84	<0.0001
eGFR (ml/min/1.73m2)	10.28± 4.18	103.56±10.15	-60.08	<0.0001

Table 2: Correlation of serum uric acid levels with eGFR

	Serum uric acid	eGFR	Correlation coefficient	P value	Significance
Mean ± SD	8.02 ± 1.84	10.28± 4.18	-0.463	0.000	significant

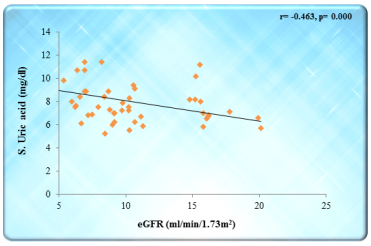

Figure 1: Correlation of serum uric acid levels with eGFR

DISCUSSION:

Uric acid has been suggested to association with many diseases since the 19th century.[10] Kidney excretion of uric acid is decrease in case of renal failure result hyperuricemia. UA perform varying biological functions like antioxidant, role in immune system and proinfla m matory pathways. [11-14]

In the present study, it was found that, there was a statistically significant blood urea, serum creatinine and serum uric acid higher in CKD patients as compared to healthy subjects.

High level of serum uric acid was found to be associated with significant fall in eGFR. Finding of the study suggest a strong association of hyperuricemia with progression of CKD. Therefore, uric acid can be considered as an independent risk factor for development of end stage renal disease (ESRD). The observations are similar to the study done by Sarpal V.[8]

Sarpal V reported the positive correlation between increased serum uric acid and progression of decline renal function. Chen et al 2014 were found there was statistically highly significant positive correlation of serum UA with stages and severity of chronic kidney disease, duration of illness and markers of reduced renal functions like serum BUN and serum creatnine and negatively correlate with eGFR. [15-17]

Tsai C W et al 2017 supports that hyperuricemia is associated with a greater decline in renal function and a higher risk of progressing to kidney failure.[18]

Zhang et al. reported seven randomized controlled trials involving 451 participants and shows that uric acid lowering therapy could delay the progression of CKD.[19]

There are a number of mechanisms by which high levels of UA increases the risk for CKD development. In a study in rats, hyperuricemia increased systemic blood pressure, proteinuria, renal dysfunction, progressive renal scarring and induced vascular disease via a COX-2- dependent pathway.[20] Chini LSN concluded that UA had a weak, but significant association with baseline eGFR.[21]

CONCLUSION:

Finding of the study suggest a strong association of hyperuricemia with progression of CKD. Uric acid can be considered as an independent risk factor for development of end stage renal disease (ESRD).

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