Original Article

Association of Serum Uric Acid with Nutritional Risk Index in Maintenance Hemodialysis Patients

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ABSTRACT

Background: Nutritional status assessment is important in detection of protein energy malnutrition in Chronic Kidney Disease (CKD) patients on Maintenance Hemodialysis (MHD). Nutritional Risk Index can be used as a screening tool for assessment of nutritional status with high sensitivity.

Aims and objectives:

- To assess the serum uric acid levels and nutritional risk index in maintenance hemodialysis patients
- To correlate serum uric acid and NRI in MHD patients.

Materials and Methods: A Cross sectional study was done in 50 End Stage Renal Disease (ESRD) patients undergoing therapeutic hemodialysis. Anthropometric measurements were noted and all the patients were analyzed for serum urea, creatinine, uric acid and albumin. NRI was calculated by NRI = (1.519 × serum albumin (g/L) + 41.7× (present weight/usual weight).

Results: The mean values of uric acid and albumin in MHD patients were 5.15± 1.15 mg/dl and 3.39± 0.40 g/dl respectively. Mean NRI score was 96.54± 3.89. 54% of patients had moderate risk, 8% had mild risk and 39% had no risk of malnutrition. Serum uric acid had a significant positive correlation with albumin (r= 0.39) and NRI (r= 0.68), (p value < 0.001). Serum uric acid positively associates with albumin and nutritional status in MHD patients. So, assessment of malnutrition and correction at an earlier stage can be done by using simple markers like serum uric acid.

Conclusion: Serum Uric acid levels are significantly associated with Nutritional parameters in MHD patients and can be used as a marker of Nutritional status in them.

Key words: Uric Acid, Maintenance Hemodialysis, Protein energy malnutrition, Nutritional Risk index.

INTRODUCTION:

Chronic Kidney Disease is the progressive loss in the kidney function over a period of months or years. Stage 5 chronic kidney disease is often called as end stage renal failure.

Assessment of nutritional status in individuals with chronic kidney disease, including long term hemodialysis (HD) patients, is crucial because malnutrition and wasting syndromes are strong risk factors for morbidity and mortality[1].

Nutritional status assessment is important in the detection of protein energy malnutrition (PEM), dietary requirements, and the development of the alternative nutritional therapies in chronic kidney disease patients[2]. Assessment of nutritional status has assumed greater importance because of the

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association of malnutrition with increasing morbidity and mortality.[3,4,5]

The geriatric nutritional risk index (GNRI) is a very simple method based on body weight, height and serum albumin levels to assess nutritional status in various pathological conditions. Studies have investigated the reliability of GNRI in assessing malnutrition and in predicting all-cause mortality in chronic HD patients.[6]

There are several methods for the assessment of nutrition, including subjective global assessment (SGA)[7] and malnutrition - inflammation score.[1] However, recently, the Geriatric Nutritional Risk Index (GNRI) has been reported as a simple and accurate tool to assess the nutritional status in HD patients.[8]

Recent studies have stated uric acid as a clinically useful nutritional marker and predictor of outcome in MHD patients.[10] Uric acid is the end product of purine metabolism and a huge proportion of the daily synthesized amount is excreted through kidneys. Due to lack of renal clearance, a significant amount of uric acid accumulates in ESRD patients. A latest study has stated serum uric acid (UA) as a good nutritional marker. Longitudinal changes in serum UA seem to track with changes in nutritional status over time, and these changes are associated with survival of patients on maintenance hemodialysis.[11] An increase in serum UA levels over time is accompanied by improvement of nutritional status and lower mortality rate.[10] Based on this background, the study was designed to assess the association of the uric acid levels with Nutritional status in MHD patients.

MATERIALS AND METHODS:

A cross sectional study was done on 50 patients undergoing therapeutic hemodialysis (three times weekly) for more than one year in the Nephrology department of Vinayaka Mission's Kirupananda Variyar Medical College. All the patients undergoing chronic hemodialysis were considered for the study. Patients with known cardiac diseases, autoimmune diseases, known hepatic diseases, gout and chronic infectious diseases were excluded. The study was carried out over a period of 2 months from April 2016 to May 2016. The structured protocol was submitted to the Institutional ethical committee and was approved. Informed consent from each patient was obtained after explaining the nature of the study.

All the study subjects answered a questionnaire which contains details of age, gender, smoking, symptoms and etiology of ESRD, history of medications and duration of hemodialysis. Height, Weight, Waist circumference, Hip circumference, Blood pressure were taken for all the patients. Body mass index (BMI) and Waist Hip ratio (WHR) were calculated. BMI was calculated by dividing the body weight (in kilograms) by the square of height (in meters) [Quetelet's index]. BMI =Body weight (kg)/ Height $(m)^2$

Venous blood samples were collected from all the subjects immediately before the HD procedure, after getting informed consent. The samples were analyzed for urea, creatinine, albumin and serum uric acid levels by using a semi automated analyzer Photometer 5010. Biochemical parameters such as Creatinine and Uric acid were measured by Enzymatic method. Serum Albumin was measured by Bromo Cresol Green method and Urea by modified Berthelot method.

Nutritional risk index is calculated by using the formula,

NRI = (1.519 × serum albumin (g/L) + 41.7× (present weight/usual weight).

The patients with NRI score of >100 were considered in no risk group, 97.5–100 mild risk, 83.5–97.5 moderate risk, and <83.5 has severe risk groups.[6]

STATISTICAL ANALYSIS:

All statistical analyses were performed using SPSS software, version 17.0. The results were presented as mean ± standard deviation. Pearson's rank correlation coefficient was used to evaluate the relationship between uric acid and NRI. Based on the r-value, association between uric acid and NRI were derived. A p-value of 0.05 was set as significant.

RESULTS:

Table 1 depicts the general and biochemical characteristics of HD patients.

Table 2 depicts the correlation of uric acid with other variables of hemodialysis patients.

The mean age of MHD patients in this study was 49.5 ± 10.79 yrs and the patient underwent MHD for a median duration of 1.46 ± 0.93 yrs.

Table-1 : Biochemical characteristics of Hemodialysis patients

S.No	Variables	Mean ± Standard deviation	
1.	Age (Yrs)	49.5 ± 10.79	
2.	Sex (M/F)	36 /14	
3.	Dialysis duration (yrs)	1.46 ± 0.93	
4.	BMI	21.2± 3.6	
5.	WHR	0.6 ± 0.25	
6.	Urea (mg/dl)	57.8± 36	
7.	Creatinine (mg/dl)	4.2± 2.6	
8.	Albumin (g/dl)	3.4± 0.4	
9.	Uric acid (mg/dl)	5.15 ± 1.15	
10.	Nutritional risk index	96.54 ± 3.89	
11.	BP (mmHg)	Systolic	Diastolic
		149± 15.8	93.3± 9.6

Table-2 : Correlation of uric acid with other variables of hemodialysis patients

Correlation	Uric acid	
	r value	p value
Age	-0.161	0.45
Dialysis duration	0.55	0.024
Albumin	0.39	<0.05*
Urea	0.40	0.034
NRI	0.68	<0.001*
Creatinine	0.30	0.03

* Significant

DISCUSSION:

Hemodialysis is a renal replacement therapy that replaces kidney function. It filters waste, removes extra fluid and balances electrolytes.[10] It is a way to treat advanced kidney failure and helps to carry on an active lifestyle despite kidney failure. The hemodialysis patients are more prone for malnutrition[17]. Multiple mechanisms have been reported to explain the association between malnutrition and mortality in HD patients, including derangements in muscle, adipose tissue, gastrointestinal, hematopoietic and immune systems, abnormal activation of the inflammatory process[2]. Malnutrition is a powerful predictor of morbidity and mortality[7]. Hence it is necessary to assess the nutritional status of renal failure patients periodically and take measures to prevent PEM. The various methods commonly used for assessment of nutritional status are dietary recall, subjective global assessment (SGA), anthropometric measurements and serum albumin.

14 (28%) of the study subjects were women and 36 (72%) were men. The mean age was 49.5 ± 10.79 years. The duration of dialysis was 1.46 ± 0.93 yrs. The BMI was 21.2 ± 3.6 and the WHR was 0.6 ± 0.25.

The geriatric nutritional risk index (GNRI) is a very simple method based on body weight, height and serum albumin levels to assess nutritional status in hemodialysis patients[8]. The Kaplan-Meier analysis revealed that subjects with a GNRI < 91 (n = 29) had a significant lower survival rate compared with that of those with a GNRI > 91 (n = 230) (P < 0.0001)[6].

Yamada et al[6] suggested that the most accurate GNRI cut-off value to identify malnourished HD patients was <91.2, based on the Malnutrition Inflammation Score. Kobayashi et al.[7] reported that HD patients with GNRI <90 exhibited a poor nutritional status in terms of a lower BMI, serum levels of albumin and creatinine compared with GNRI >90. Park et al[8] confirmed in Korean HD patients that GNRI may be a significant predictor of mortality. More recently, Panichi et al[9] have shown that values lower than 92 may represent a strong indicator of unfavorable outcome in Caucasian HD patients.

Nutritional risk factor is one of the strong predictors of mortality in HD patients. The NRI was originally derived from the serum albumin concentration and the ratio of present to usual weight

NRI = (1.519 × serum albumin, g/dL) + {41.7 × present weight (kg)/ Ideal body weight(kg)}.

From these NRI values, we defined four grades of nutrition-related risk:

i) major risk (NRI<83.5)
ii) moderate risk (NRI 83.5–97.5)
iii) mild risk (NRI 97.5–100)
iv) No risk (NRI > 100).

In our study, the mean NRI score was 96.54 ± 3.89[21]. 54% of patients had moderate risk, 8% had mild risk and 39% had no risk of malnutrition. A similar study in the same region, has shown a higher incidence of 96% of malnutrition in HD patients[17]. The NRI consists of few objective components, including serum albumin and BMI and represents a simple nutritional screening tool[12]. The NRI score has been shown to predict increased healthcare costs and higher risk of hospitalization in independent-living older adults, so it may be a low-cost tool that might be routinely used in population-based settings[16].

Malnutrition and low serum albumin have been shown in the dialysis population to directly correlate with mortality. Our study shows, the mean value of albumin in MHD patients were 3.39 ± 0.40 g/dl which was higher with the study by VijayaBanu.N et al[17] which shows the mean serum albumin level in the study subjects was 2.8 ± 0.4 mg/dl. Serum albumin level less than 3.5 mg/dl has been shown to be associated with increased mortality rate, showed that malnutrition was predicted best by hs-CRP and IL-6 levels; CVD, by IL-6 level; and mortality, by albumin[18].

Uric acid is a final enzymatic product in the degradation of purine nucleotides, and it is a normal component of urine. Uric acid is a strong reducing agent (electron donor) and a potent antioxidant. In a comprehensive study, Kuzkaya et al[1] showed that uric acid is a unique scavenger of peroxynitrite in the extracellular space. Over, half of the antioxidant capacity of blood plasma comes from hydrogen urate ion. High uric acid concentrations are associated with lower mortality among hemodialysis (HD) patients[22].

In our study, the mean concentration of uric acid was 5.15 ± 1.15 mg/dl, Serum uric acid had a significant positive correlation with albumin (r=

0.39) and NRI (r= 0.68). (p value < 0.001)which is consistent with the study conducted by S.M. Kurt Lee et al.[20] in which low serum uric acid is a mortality risk factor in incident hemodialysis patients with a high comorbidity burden and hypoalbuminemia. The principal finding was that uric acid levels in the lowest quintile (< 5.2 mg/dl) were associated with greater than 2-fold increased risk for death in the first year of dialysis[20].

CONCLUSION:

The results of the present study clearly indicate that a major proportion of MHD patients suffer from malnutrition. NRI is a very simple tool that can be used for the assessment of malnutrition. Elevated uric acid levels has been associated with decreasing the risk of malnutrition in HD patients

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