

**STUDY ON URIC ACID LEVELS AND RELATED FACTORS
IN HEMODIALYSIS PATIENTS AT MILITARY HOSPITAL 103**

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Abstract

Objectives: To investigate uric acid (UA) levels and their association with certain clinical and paraclinical characteristics in patients undergoing maintenance hemodialysis (MHD). **Methods:** A cross-sectional descriptive study was conducted on 69 patients with end-stage chronic kidney disease (ESRD) receiving MHD at the Nephrology and Hemodialysis Department, Military Hospital 103, from December 2023 to March 2025. **Results:** The mean UA level was 464.09 ± 122.26 $\mu\text{mol/L}$. The prevalence of hyperuricemia among the study population was 69.57%. UA levels were significantly associated ($p < 0.05$) and moderately positively correlated with carotid intima-media thickness (CIMT) ($r = 0.448$; $p = 0.0001$) and blood creatinine levels ($r = 0.305$; $p = 0.011$). No significant association was found between UA levels and age, sex, body mass index (BMI), causes of chronic kidney disease (CKD), duration of MHD, residual urine output, or dyslipidemia ($p > 0.05$). Multivariate analysis showed that low BMI, high hemoglobin levels, and blood creatinine levels were independent risk factors for hyperuricemia, with ORs of 0.78, 1.05, and 1.00, respectively ($p < 0.05$). **Conclusion:** Patients undergoing MHD have elevated UA levels due to reduced renal clearance. Elevated UA levels are associated with increased CIMT and a higher risk of cardiovascular complications. Ensuring adequate nutrition and adherence to sufficient dialysis sessions may help control UA levels within normal limits, reduce CIMT, lower cardiovascular risk, decrease mortality, and improve treatment outcomes.

Keywords: End-stage chronic kidney disease; Maintenance hemodialysis; Uric acid level.

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Date received: 21/8/2025

Date accepted: 12/11/2025

<http://doi.org/10.56535/jmpm.v51i4.1666>

INTRODUCTION

Uric acid is the final degradation product of nucleotides containing purine bases and is mainly excreted through the kidneys (60 - 70%). Reduced renal function decreases the ability to eliminate UA, and it is estimated that about 40 - 80% of patients with ESRD have hyperuricemia [1]. UA is involved in the activation of inflammatory processes, promoting the synthesis of proinflammatory cytokines and oxidative products, leading to vascular endothelial dysfunction. Recent studies have shown that increased UA is an independent risk factor for cardiovascular diseases such as hypertension, atherosclerosis, and coronary artery disease – common complications and the leading cause of death in CKD patients, especially those undergoing MHD [2]. Therefore, lowering uric acid levels in patients with CKD in general and ESRD patients on MHD in particular plays an important role in improving prognosis and treatment outcomes. Both globally and in Vietnam, numerous studies have investigated the relationship between UA levels and CKD; however, the results remain inconsistent. Based on these considerations, we conducted this study to: *Evaluate UA levels and their relationship with several clinical and laboratory characteristics in hemodialysis patients at the Nephrology and Hemodialysis Department, Military Hospital 103.*

MATERIALS AND METHODS

1. Subjects

Including 69 patients diagnosed with stage 5 CKD undergoing MHD at the Nephrology and Hemodialysis Department, Military Hospital 103, from December 2023 to March 2025.

** Inclusion criteria:* Stage 5 CKD patients receiving renal replacement therapy with MHD; duration of MHD ≥ 3 months; age ≥ 18 years; receiving MHD under the same treatment regimen; comorbidities managed according to the guidelines of the Ministry of Health of Vietnam with individualized adjustments; cooperative patients who consented to participate in the study.

** Exclusion criteria:* Severe chronic heart failure (NYHA class III or IV); presence of severe acute conditions such as infection, myocardial infarction, acute heart failure, stroke, severe liver failure, or cancer; patients requiring special dialysis regimens due to conditions such as acute pulmonary edema or hyperkalemia requiring emergency dialysis.

2. Methods

** Study design:* A cross-sectional descriptive study.

** Sample size:* 69 patients who met the inclusion criteria and did not violate the exclusion criteria.

** Sampling method:* Convenience sampling.

** Data collection procedure:* Patients enrolled in the study underwent medical

history taking, clinical examination, laboratory tests, blood sampling before the mid-week hemodialysis session, CIMT measurement by ultrasound. Data were recorded in the research medical records.

* *Data collection and analysis:* Data were entered into Microsoft Excel and analyzed using STATA version 14.0. Statistical significance was set at $p < 0.05$.

3. Ethics

The study was approved by the Ethics Council of Military Hospital 103 according to Decision No. 2030/KH-HDDD dated June 23, 2023. Military Hospital 103 granted permission for the use and publication of the research data. The authors declare to have no conflicts of interest in the study.

RESULTS

Table 1. Baseline characteristics of the study population.

Characteristics (n (%)/Median (IQR)/ $\bar{X} \pm SD$ /Min - Max)	Total (n = 69)
Age (years)	38.75 $\pm$ 11.24 (18 - 78)
Male gender	44 (64%)
BMI (kg/m ²)	21.20 $\pm$ 2.84
Cause of CKD	
Glomerulonephritis	61 (88.41%)
Others*	8 (11.59%)
Duration of MHD (months)	29.98 $\pm$ 33.33
Hypertension	65 (94.2%)
Residual urine output	16 (23.19%)
Hemoglobin (g/L)	104.81 $\pm$ 15.84
Dyslipidemia	41 (59.42%)
Albumin (g/L)	42.42 $\pm$ 3.91
CIMT (mm)	0.89 $\pm$ 0.18

(*: Diabetes, hypertension, polycystic kidney disease, chronic pyelonephritis, and unknown etiology)

The study subjects had a mean age of 38.75 $\pm$ 11.24 years, with a predominance of males (64%). The mean BMI was 21.20 $\pm$ 2.84 kg/m². Glomerulonephritis (GN) was the main cause of CKD, accounting for 88.41%. The mean duration of MHD was 29.98 $\pm$ 33.33 months. Most patients had hypertension (94.2%), while only 23.19% retained residual urine output. The mean hemoglobin concentration was 104.81 $\pm$ 15.84 g/L, and 59.42% of patients presented with dyslipidemia. The mean albumin level was 42.42 $\pm$ 3.91 g/L, and the mean CIMT was 0.89 $\pm$ 0.18mm.

Table 2. Characteristics of UA levels (n = 69).

Characteristic of UA levels	Value
Increased, n (%)	48 (69.57)
Normal, n (%)	21 (30.43)
Decreased, n (%)	0 (0)
$\bar{X} \pm SD$ ($\mu\text{mol/L}$)	464.09 ± 122.26
Min - Max	255.0 - 751.5

There were 69.57% of patients with elevated UA levels, while the rest were within the normal range, and no patients had decreased levels. The mean UA level in the study group was $464.09 \pm 122.26 \mu\text{mol/L}$, with the lowest value of $255.0 \mu\text{mol/L}$ and the highest of $751.5 \mu\text{mol/L}$.

Table 3. The association between UA levels and some clinical and paraclinical characteristics (n = 69).

Indices	UA levels		p
	Increased (n = 48)	Normal (n = 21)	
Age (years)			
< 30	8	4	0.167 ^a
30 - < 40	15	11	
≥ 40	25	6	
BMI (kg/m^2)			
< 23	37	14	0.599 ^a
≥ 23	11	7	
Duration of MHD (years)			
< 5	36	19	0.141 ^a
≥ 5	12	2	
Anemia			
Yes	44	20	0.599 ^a
No	4	1	
Dyslipidemia			
Yes	30	11	0.431 ^a
No	18	10	
CIMT (mm)			
< 0.9	13	11	0.042 ^a (OR = 4.12)
≥ 0.9	35	10	

(^a: Chi-square test)

There was a statistically significant association between UA levels and CIMT, with $p < 0.05$ and OR = 4.12. No statistically significant associations were found between UA levels and age, BMI, duration of MHD, anemia, or dyslipidemia ($p > 0.05$).

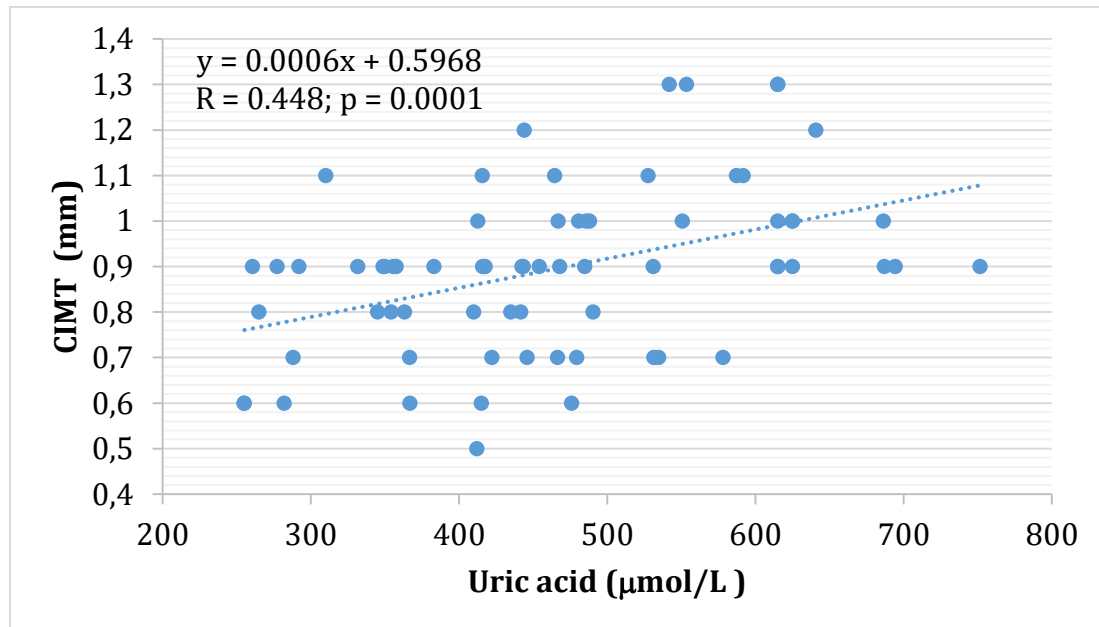


Figure 1. The correlation between CIMT and UA levels.

UA levels showed a moderate, statistically significant correlation with CIMT ($r = 0.448$; $p = 0.0001$).

Table 4. The correlation between UA levels and some parameters.

Parameters	UA ($\mu\text{mol/L}$)		Regression equation
	r	p	
Ure (mmol/L)	0.192	0.114	
Creatinine ($\mu\text{mol/L}$)	0.305	0.011	$y = 0.1539x + 311.28$
CRP (mg/L)	- 0.09	0.476	
Albumin (g/L)	0.119	0.327	
Hemoglobin (g/L)	0.124	0.31	

UA levels were moderately and positively correlated with creatinine levels, with statistical significance ($r = 0.305$; $p = 0.011$). There was no statistically significant correlation between UA levels and blood urea, CRP, albumin, or hemoglobin ($p > 0.05$).

Table 5. Multivariate analysis of factors associated with hyperuricemia.

Factors	OR	95%CI	p
Age (years)	1.01	0.94 - 1.08	0.840
BMI (kg/m ²)	0.78	0.61 - 0.99	0.044
Hemoglobin (g/L)	1.05	1.00 - 1.10	0.048
Ure (mmol/L)	0.95	0.86 - 1.05	0.308
Creatinine (μmol/L)	1.00	1.00 - 1.01	0.042
Dyslipidemia	1.97	0.56 - 6.95	0.293

Increased hemoglobin level, elevated creatinine, and lower BMI were independent risk factors for hyperuricemia ($p < 0.05$).

DISCUSSION

Hyperuricemia is relatively common in patients with CKD in general and in those with ESRD undergoing MHD in particular [1]. We conducted a study on 69 MHD patients with a mean age of 38.75 ± 11.24 years; the main cause of CKD was GN (88.41%). Our findings are consistent with many domestic studies, such as that of Ha Thi Thu Nguyen et al. (2022), who studied ESRD patients eligible for kidney transplantation with a mean age of 39.38 ± 11.84 years, and reported GN as the leading cause (88.8%) [3]. In contrast to high-income countries, where diabetes and hypertension are the main causes of CKD, in middle- and low-income countries, including many Asian countries such as Vietnam, GN remains the predominant cause.

The prevalence of hyperuricemia in our study was 69.57%, with a mean UA

level of 464.09 ± 122.26 μmol/L, which was lower than that reported by Trung Anh Hoang et al. (2017) in a study of 369 MHD patients at Bach Mai Hospital (mean UA level 558.96 ± 107.97 μmol/L; prevalence 93.2%) [4]. This difference may be due to the timing of blood sampling: In our study, samples were collected before the mid-week dialysis session, while in theirs, samples were taken before the first session of the week (after a longer interdialytic interval).

UA levels were significantly and moderately correlated with CIMT. This result is consistent with that of Kara AV et al. (2024), who studied 77 MHD patients [5]. CIMT reflects carotid atherosclerosis; therefore, controlling serum UA levels may contribute to reducing atherosclerosis and lowering the risk of cardiovascular complications.

UA levels also showed a significant moderate positive correlation with creatinine levels ($r = 0.305$, $p = 0.011$), which is consistent with the findings by Trung Anh Hoang (2017) [4]. Since UA is excreted primarily via the kidneys (60 - 70%), UA levels are directly related to creatinine levels.

In our study, no statistically significant associations were observed between UA levels and age, BMI, duration of MHD, anemia, or dyslipidemia. Compared with previous studies, our findings showed both similarities and differences. For instance, Trung Anh Hoang (2017) also reported no significant association between UA levels and age (similar to our findings), but did find the associations with MHD duration, BMI, and dyslipidemia. These discrepancies may be due to the smaller sample size in our study. However, our findings are in line with those of Trang Thi Thu Bui et al. (2023), who studied 80 MHD patients at Saint Paul General Hospital and found no significant associations between UA levels and MHD duration or BMI; and with those by Eghlim Nemati et al. (2017), who conducted a multicenter cross-sectional study on 1,271 hemodialysis patients and also reported no relationship between MHD duration and UA levels [6].

Dalbeth N et al. (2020) investigated healthy individuals and found that high BMI was a risk factor for hyperuricemia: Individuals with high BMI exhibited increased renal reabsorption of UA

during fasting and after a purine-rich diet, and reduced renal clearance [7]. However, in our multivariate regression analysis, low BMI emerged as an independent risk factor for hyperuricemia. This may be explained by the fact that UA is a low molecular weight compound that is readily cleared through the dialyzer membrane. Therefore, the difference in UA levels among BMI subgroups may not depend on renal reabsorption or clearance, but rather on dialysis efficiency. Patients with low BMI often have poor nutritional status and poor treatment adherence. Inagaki K et al. (2022) reported that low-BMI patients on MHD had higher mortality rates compared with those with normal or high BMI [8]. Thus, low BMI in MHD patients may be a factor reducing treatment outcomes and dialysis efficiency, leading to impaired clearance of waste products, including UA.

CONCLUSION

The mean UA level in the study was 464.09 ± 122.26 $\mu\text{mol/L}$, with a high prevalence of hyperuricemia accounting for 69.57%. UA levels were significantly associated ($p < 0.05$) and showed a moderately positive correlation with CIMT ($r = 0.448$; $p = 0.0001$), as well as with creatinine levels ($r = 0.305$; $p = 0.011$). No significant associations were observed between UA levels and age, BMI, duration of MHD, anemia, or dyslipidemia ($p > 0.05$). Multivariate

regression analysis revealed that low BMI, higher creatinine levels, and elevated hemoglobin concentration were independent risk factors for hyperuricemia, with ORs of 0.78, 1.05, and 1.00, respectively ($p < 0.05$).

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