ORIGINAL ARTICLE

High Prevalence of Hyperkalemia and Regional Disparities Among Advanced CKD Patients in Chanthaburi, Thailand: Implications for Clinical Practice

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Background: Hyperkalemia is a serious complication in chronic kidney disease (CKD) patients, potentially leading to life-threatening outcomes. While its prevalence is well-documented in Western populations, limited data exist in Thailand, particularly in Chanthaburi Province, an area rich in potassium-containing fruits.

Objective: To determine the prevalence and risk factors of hyperkalemia among patients with advanced CKD in Chanthaburi.

Materials and Methods: A cross-sectional study was conducted at the CKD clinic of Prapokklao Hospital in Chanthaburi Province, Thailand, between July 2023 and March 2024. Adult CKD patients with an estimated glomerular filtration rate (eGFR) of less than 30 mL/minute/1.73 m^2 were included, excluding those on dialysis or kidney transplant recipients. Demographic data, comorbidities, laboratory parameters, and medication profiles were recorded. Univariable and multivariable logistic regression analyses were performed to identify independent risk factors associated with hyperkalemia, defined as serum potassium levels of 5 mEq/L or more.

Results: From a screening of 1,130 patients in the CKD clinic, 171 were selected for analysis. The average age of the patients was 68.2±15.5 years, with a mean eGFR of 9.4±6.8 mL/minute/1.73 m^2. The prevalence of hyperkalemia among these patients was 19.9%, with the highest incidence observed in the Lamsing District, where the average serum potassium level was 4.9±0.9 mEq/L. Multivariable analysis identified chronic heart failure and eGFR of less than 8 mL/minute/1.73 m^2 as significant independent risk factors associated with hyperkalemia.

Conclusion: The present study revealed a high prevalence of hyperkalemia in Chanthaburi Province, with significant variability in average serum potassium levels across different regions. This variability emphasized the necessity of prioritizing preventive measures in areas with more pronounced issues. Therefore, particular attention should be directed toward patients with chronic heart failure and an eGFR of less than 8 mL/minute/1.73 m^2.

Keywords: Chronic Kidney Disease; Hyperkalemia; Potassium; Geographic variation

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Hyperkalemia is a critical complication in the realm of chronic kidney disease (CKD). With elevated serum potassium levels, it was a life-threatening condition due to the precipitated risk of neuromuscular complications, arrhythmia, and cardiac arrest[1-3]. The prevalence of hyperkalemia varies widely across CKD populations, influenced by factors such as the stage of CKD progression and the chosen serum potassium threshold for diagnosis[4-6]. Moreover, the association between hyperkalemia and CKD becomes notably pronounced in the context of hemodialysis (HD)[7].

The previous studies have identified independent risk factors associated with hyperkalemia, including diabetes, heart failure, low estimated glomerular filtration rate (eGFR), and the use of medications that interfere with the renin angiotensin system (RAS)[6,8]. While the evidence linking dietary potassium intake to hyperkalemia is weak, dietary potassium restriction remains a potential strategy for controlling hyperkalemia among CKD patients[9,10]. However, the prevalence of hyperkalemia varies across regions, and environments rich in potassium-enriched foods may be associated with a higher prevalence of hyperkalemia[11,12].

Chanthaburi, a province in Eastern Thailand, is renowned for its variety of fruits such as durian,

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mango, and banana, which are high in potassium[13,14]. Additionally, some areas of Chanthaburi are located near the sea, providing easy access to fish, another source of potassium. However, evidence regarding the prevalence of hyperkalemia among CKD patients in Chanthaburi is still lacking. Therefore, the authors' aim was to investigate the prevalence and risk factors of hyperkalemia among advanced CKD patients in Chanthaburi Province.

Materials and Methods

Study design

A cross-sectional study was conducted at the CKD clinic of Prapokklao Hospital in Chanthaburi Province, Thailand, between July 2023 and March 2024. Prapokklao Hospital served as both a tertiary care center and a referral center for CKD patients in Chanthaburi. The CKD clinic accepted referrals from primary care hospitals for patients with eGFR below 30 mL/minute/1.73 m^2, as well as CKD patients with eGFR less than 60 mL/minute/1.73 m^2 in Mueang District, Chanthaburi Province. Patients received treatment from nephrologists and internists. The present study was approved by the Chanthaburi Research Ethics Committee, Region 6 (CTIREC014/66), and registered at the Thai Clinical Trials Registry number TCTR20240401002.

Population and data collection

The authors collected data during a pre-specified 10-month period, between July 2023 and March 2024, encompassing all patients regularly attending the CKD clinic. Eligible participants included individuals aged 18 years and above diagnosed with advanced CKD, defined by eGFR of less than 30 mL/minute/1.73 m^2. Patients undergoing dialysis or who received kidney transplantation were excluded. Demographic data were recorded for all eligible participants, along with details of comorbidities, current medication profiles, and laboratory parameters, retrieved from electronic medical records and patient interviews.

Definition and outcome measures

The primary outcome measure was the prevalence of hyperkalemia, defined as serum potassium levels of 5.0 mEq/L or more. The authors also chose a threshold level of 5.0 mEq/L for both univariable and multivariable analyses to investigate factors associated with hyperkalemia among advanced CKD patients in Chanthaburi Province. This threshold was selected to maintain consistency within the authors' hospital protocols and practices. Additionally, eGFR was estimated from serum creatinine levels with the use of the CKD-EPI equation.

Statistical analysis

Descriptive statistics were used to summarize demographic characteristics and laboratory parameters. Continuous variables were reported as means with standard deviations, while categorical variables were presented as frequencies and percentages. Univariable logistic regression analyses were first performed to identify potential risk factors for hyperkalemia. Variables with a p-value less than 0.05 in the univariable analyses were subsequently included in the multivariable logistic regression model to identify independent risk factors associated with hyperkalemia. All statistical analyses were performed using Stata Statistical Software, version 18 (StataCorp LLC, College Station, TX, USA), with statistical significance set at p-value less than 0.05.

Results

Demographic characteristics and laboratory parameters

From a cohort of 1,130 advanced CKD patients who underwent regular follow-ups at the CKD Clinic, Prapokklao Hospital, between July 2023 and March 2024, 782 HD patients, 126 Peritoneal Dialysis (PD) patients, and two kidney transplant (KT) recipients were excluded. Moreover, 49 patients lacking laboratory results during their scheduled visits were excluded from the present study. Therefore, the final analysis included 171 advanced CKD patients, with 34 individuals classified into the hyperkalemia group and 137 into the non-hyperkalemia group (Figure 1).

The mean age of participants was 68.2 years (SD 15.5), with 74 (43.3%) being male. Additionally, 64 participants (37.4%) resided in districts near the sea. The number of CKD patients with hyperkalemia by district was as follows, 56 patients from Mueng District, six from Makham, seven from Soidao, eight from Lamsing, nine from Pongnamron, nine from Na-Yai-Arm , 28 from Thamai, nine from Khitchakut, 19 from Khlung, and six from Kaeng-Hang-Maeo. The most common comorbidities were hypertension, in 94.7%, diabetes in 54.4%, and dyslipidemia in 8.8%. Among participants, 65.5% utilized calcium channel blockers (CCBs). All patients who received CCBs in the present study were prescribed dihydropyridine-type agents, whereas only 2.9% employed RAS blockage. Furthermore, 21.6% of participants relied on insulin for blood sugar control, as shown in Table 1.

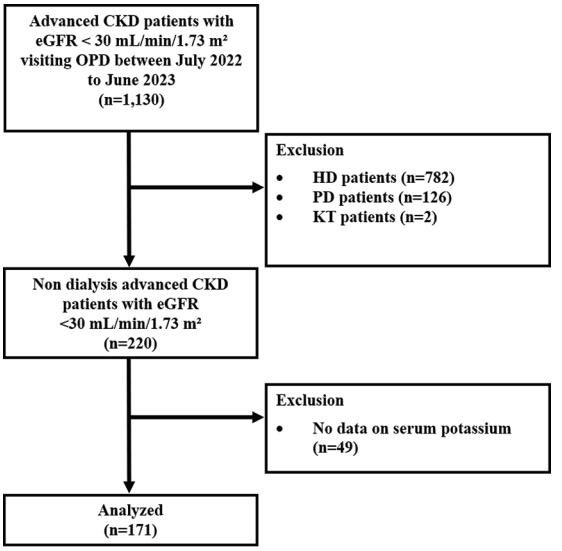

Figure 1. Study flow diagram.

CKD, chronic kidney disease; HD, hemodialysis; KT, kidney transplantation; PD, peritoneal dialysis

Prevalence of hyperkalemia

The average potassium level among advanced CKD patients in Chanthaburi Province was 4.4 (SD 0.8) mEq/L, with a hyperkalemia prevalence of 19.9% across the population. To visualize regional variations, the authors generated a color-coded heat map illustrating mean serum potassium levels across different districts in Chanthaburi Province (Figure 2).

In the map, districts with notably high mean serum potassium levels are shown in red and included Lamsing District with a mean serum potassium of 4.9 (SD 0.9), Khitchakut District with a mean serum potassium of 4.8 (SD 1.3), Makham District with a mean serum potassium of 4.7 (SD 0.7), Pongnamron District with a mean serum potassium of 4.7 (SD 0.7), and Khlung District with a mean serum potassium of 4.7 (SD 0.8). Meanwhile, districts exhibiting moderately elevated serum potassium levels, which is shown in orange, consisted of Mueang, Na-Yai-Arm, Thamai, and Soidao, with mean serum potassium levels ranging from 4.1 to 4.4. The lowest mean serum potassium was 3.6 (SD 0.3) in Kaeng-Hang-Maeo District.

Factors associated hyperkalemia

In univariable comparisons (Table 1), individuals with serum potassium of 5.0 mEq/L or more were significantly older at 74.2 versus 66.7 years. The percentage of males in the hyperkalemia group was 41.2%, compared with 43.8% in the non-hypokalemia group, but these differences did not reach statistical significance. The two groups also did not differ significantly in terms of body mass index (BMI), blood pressure levels, the percentage of participants living near the sea, etiologies of CKD, and comorbidities, except for a higher percentage of chronic heart failure in the hyperkalemia group.

As shown in Table 1, there were no significant differences in most routine biochemistry parameters between the two groups; however, mean eGFR and serum bicarbonate displayed a trend towards lower levels in individuals with high potassium.

Although there was no difference in the percentage of patients with high potassium receiving RAS blockage between the two groups, the percentage of those receiving a CCB was higher than the patients

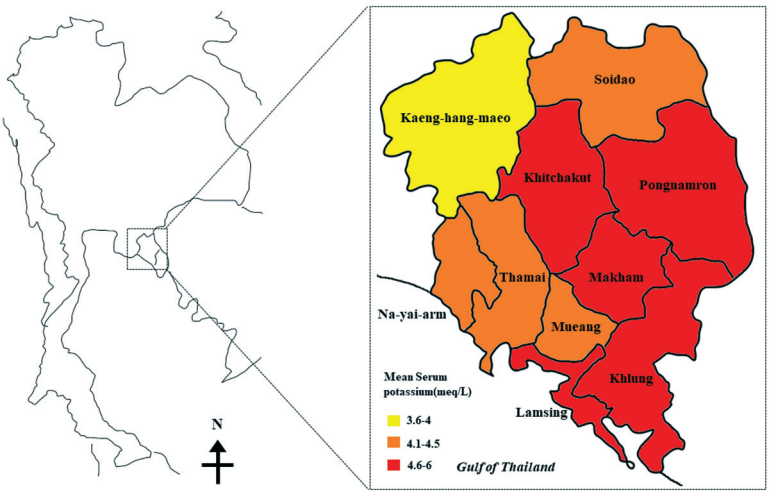

Figure 2. Color-coded heat map showing mean serum potassium levels in each district in Chanthaburi Province, Eastern Thailand.

Table 1. Patient and biochemical characteristics of patient in hyperkalemia and non-hyperkalemia group

Variables	All patients (n=171)	Hyperkalemia group (n=34)	Non-hyperkalemia group (n=137)	p-value
Age (years); mean [SD]	68.2 [15.5]	74.2 [12.2]	66.7 [15.9]	0.011
Age ≥65 years; n (%)	99 (57.89)	25 (73.53)	74 (54.01)	0.039
Male; n (%)	74 (43.3)	14 (41.2)	60 (43.8)	0.783
BMI (kg/m^2); mean [SD]	22.8 [4.7]	23.9 [5.9]	22.6 [4.3]	0.137
BMI ≥30 kg/m^2; n (%)	13 (7.60)	4 (11.76)	9 (6.57)	0.306
Living district near the sea; n (%)	64 (37.4)	16 (47.1)	48 (35.0)	0.190
Etiologies of CKD; n (%)				
Diabetic kidney disease	93 (54.4)	18 (52.9)	75 (54.7)	0.850
Hypertension	74 (43.3)	17 (50.0)	57 (41.6)	0.377
Glomerulonephritis	1 (0.6)	0 (0.0)	1 (0.7)	0.617
Drug/toxin	2 (1.2)	0 (0.0)	2 (1.5)	0.479
Obstructive uropathy	2 (1.2)	0 (0.0)	2 (1.5)	0.479
Comorbidities; n (%)				
Hypertension	162 (94.7)	33 (97.1)	129 (94.2)	0.498
Diabetes	93 (54.4)	18 (52.9)	75 (54.7)	0.850
Chronic heart failure	15 (8.8)	14 (41.2)	1 (0.7)	<0.001
Dyslipidemia	73 (42.7)	16 (47.1)	57 (41.6)	0.565
Coronary heart disease	10 (5.9)	1 (2.9)	9 (6.6)	0.420
Systolic BP (mmHg); mean [SD]	138.2 [25.9]	138.7 [23.2]	138.0 [26.7]	0.898
Diastolic BP (mmHg); mean [SD]	73.3 [15.1]	73.1 [13.7]	73.4 [15.4]	0.934
BUN (mg/dL); mean [SD]	61.9 [31.8]	69.6 [39.9]	60.0 [29.3]	0.114
Creatinine (mg/dL); mean [SD]	7.1 [4.5]	7.9 [4.7]	6.9 [4.5]	0.232
eGFR (mL/minute/1.73 m^2); mean [SD]	9.4 [6.8]	5.5 [2.3]	10.3 [7.2]	<0.001
Serum albumin; mean [SD]	3.7 [0.7]	3.8 [0.5]	3.7 [0.1]	0.443
Serum sodium (mEq/L); mean [SD]	137.2 [4.9]	136.0 [6.1]	137.5 [4.6]	0.117
Serum potassium (mEq/L); mean [SD]	4.4 [0.8]	5.7 [0.4]	4.1 [0.5]	<0.001
Serum bicarbonate (mEq/L); mean [SD]	20.9 [4.0]	19.4 [4.9]	21.3 [3.7]	0.014
Medications, n (%)				
RAS blockage	5 (2.9)	1 (2.9)	4 (2.9)	0.995
CCB	112 (65.5)	28 (82.4)	84 (61.3)	0.021
Beta-blocker	59 (34.5)	13 (38.2)	46 (33.6)	0.609
Alpha-blocker	64 (37.4)	15 (44.1)	49 (35.8)	0.368
Furosemide	70 (40.9)	12 (35.3)	58 (42.3)	0.455
NaHCO3	119 (69.6)	21 (61.7)	98 (71.5)	0.268
Glipizide	4 (2.3)	0 (0.0)	4 (2.9)	0.313
Insulin	37 (21.6)	5 (14.7)	32 (23.4)	0.273
Statin	104 (60.8)	17 (50.0)	87 (83.7)	0.149

BMI=body mass index; BP=blood pressure; BUN=blood urea nitrogen; CCB=calcium channel blocker; CKD=chronic kidney disease; eGFR=estimated glomerular filtration rate; RAS=renin angiotensin system; SD=standard deviation

in the non-hyperkalemia group. Additionally, the proportion of patients using alpha-blockers, beta-blockers, furosemide, insulin, oral hypoglycemic agents, sodium bicarbonate, and statins did not differ between the groups.

The authors also conducted multivariable logistic regression analysis, with serum potassium of 5.0 mEq/L or more, as the dependent variable and demographic, clinical, and laboratory factors identified from univariable analyses as independent variables. As shown in Table 2, chronic heart failure (adjusted OR 66.7, 95% CI 6.9 to 643.7, p<0.001) and eGFR of less than 8 mL/minute/1.73 m² (adjusted OR 6.5, 95% CI 1.9 to 21.7, p=0.002) remained significant independent risk factors for hyperkalemia.

Discussion

The findings of the present study revealed a

Table 2. Univariable and multivariable logistic regression analyses for risk factors of hyperkalemia in 171 advanced chronic kidney disease patients

Variables	Univariable analysis		Multivariable analysis	
	OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age ≥65 years	2.4 (1.0 to 5.4)	0.043	2.3 (0.8 to 6.7)	0.113
Male	0.9 (0.4 to 1.9)	0.783		
BMI ≥30 kg/m^2	1.9 (0.5 to 6.6)	0.313		
Comorbidities				
Hypertension	2.0 (0.2 to 16.9)	0.507		
Diabetes	0.9 (0.4 to 2.0)	0.850		
Chronic heart failure	95.2 (11.9 to 763.8)	<0.001	66.7 (6.9 to 643.7)	<0.001
Dyslipidemia	1.2 (0.6 to 2.7)	0.565		
Coronary heart disease	0.4 (0.1 to 3.5)	0.432		
Systolic BP ≥140 mmHg	1.8 (0.8 to 3.8)	0.130		
Diastolic BP ≥90 mmHg	0.9 (0.3 to 3.0)	0.918		
BUN ≥50 mg/dL	1.2 (0.5 to 2.6)	0.664		
Creatinine ≥5 mg/dL	1.8 (0.8 to 3.9)	0.154		
eGFR <8 mL/minute/1.73 m^2	6.8 (2.5 to 18.6)	<0.001	6.5 (1.9 to 21.7)	0.002
Serum bicarbonate ≥20 mEq/L	0.6 (0.3 to 1.3)	0.232		
Medications; n (%)				
CCB	2.9 (1.1 to 7.6)	0.025	3.2 (1.0 to 10.9)	0.060
Furosemide	0.7 (0.3 to 1.6)	0.456		
RAS blockage	1.0 (0.1 to 9.3)	0.995		

BMI=body mass index; BP=blood pressure; BUN=blood urea nitrogen; CCB=calcium channel blocker; CI=confidence interval; CKD=chronic kidney disease; eGFR=estimated glomerular filtration rate; OR=odds ratio; RAS=renin angiotensin system; SD=standard deviation

high prevalence of hyperkalemia, at 19.9%, among advanced CKD patients in Chanthaburi Province, Thailand. It is consistent with the previous studies that reported hyperkalemia rates ranging from 8.1% to 26.6% among advanced CKD patients with an eGFR less than 30 mL/minute/1.73 m², with even higher prevalence observed among HD patients[5,11,15-19]. However, the prevalence of hyperkalemia in CKD still depends on other factors, such as the chosen cutoff point for serum potassium and the patient's dietary habit.

Although age of 65 years or older was associated with hyperkalemia in the univariable analysis, this association did not remain statistically significant in the multivariable analysis. However, this finding aligns with previous studies that have identified older age as a potential risk factor for hyperkalemia[20,21]. The mechanisms linking aging to hyperkalemia may involve alterations in potassium homeostasis due to age-related changes in kidney structure and function. The aging process is characterized by progressive loss of renal mass and structural changes in blood vessels, resulting in compromised renal blood flow and impaired renal auto regulation[20].

Furthermore, functional studies have demonstrated abnormal responsiveness of the microvasculature in aging kidneys to both vasodilatory and vasoconstricting substances[22,23]. These findings underscore the importance of considering age-related factors in the management of hyperkalemia among advanced CKD patients in Chanthaburi Province.

The present study results demonstrated that a low eGFR, specifically eGFR of less than 8 mL/minute/1.73 m², aggravated the risk of hyperkalemia among advanced CKD patients. As GFR declines, particularly reaching the threshold of 15 mL/minute/1.73 m², renal potassium excretion becomes significantly impaired, contributing to hyperkalemia. Additionally, metabolic acidosis was a crucial mechanism in CKD patients, inducing a shift of potassium from the intracellular to the extracellular space[24]. Therefore, treatment metabolic acidosis is needed for all advanced CKD patients to prevent hyperkalemia.

Hyperkalemia in patients with chronic heart failure could be described by several mechanisms[25]. Firstly, medication for treatment heart failure such as RAS blockage or mineralocorticoid receptor antagonist (MRA) could interfere with potassium excretion leading to hyperkalemia[26]. Secondly, impairment of renal function might not respond

adequately to aldosterone, leading to potassium retention[27]. Lastly, heart failure patients may be advised to restrict their intake of sodium and potassium-rich foods to avoid exacerbating hyperkalemia. However, dietary adherence can vary, and excess consumption of potassium-rich foods can contribute to elevated potassium levels[28]. The present study results strongly supported that chronic heart failure was an independent factor for hyperkalemia. However, patients in the present study used RAS blockage only 2.9% and no patient was on MRA. Therefore, hyperkalemia in this population may be driven by impairment of renal function and dietary habits.

The present study multivariable analysis identified chronic heart failure and severely decreased eGFR of less than 8 mL/minute/1.73 m^2, as significant independent predictors of hyperkalemia. Although 65 years or older and the use of CCBs were associated with hyperkalemia in the univariable analysis, these associations did not retain statistical significance in the multivariable model. However, the use of CCBs demonstrated borderline significance (adjusted OR 3.2, 95% CI 1.0 to 10.9, p=0.060), suggesting that further investigation in larger cohorts is warranted.

The previous studies have also reported a link between CCB use and elevated potassium levels[29,30], however, the exact mechanisms underlying this relationship remain unclear. Evidence indicates that CCBs may inhibit aldosterone production, whereas other studies suggest hyperkalemia might result from interactions with concurrent medications or underlying comorbidities, particularly CKD[31-33]. Further investigation is necessary to clarify the role of CCBs as a risk factor for hyperkalemia in this patient population.

The identification of risk factors associated with hyperkalemia suggests significant clinical implications for managing advanced CKD patients. Proactive screening for hyperkalemia, particularly among older patients with comorbid conditions such as heart failure, and lower eGFR, is crucial for close monitoring, timely intervention, and preventing adverse outcomes. However, patient characteristics and medication profiles should also be considered when selecting treatment regimens, aiming to minimize the risk of hyperkalemia while optimizing overall patient care.

In the present study, the notably low use of RAS inhibitors, at 2.9%, among advanced CKD patients may reflect clinical hesitancy due to concerns about hyperkalemia. The high baseline prevalence of hyperkalemia in this cohort, combined with practical barriers such as limited access to frequent serum potassium monitoring and longer intervals between clinic visits, influenced prescribing behavior. Despite these concerns, evidence supported the continued use of RAS inhibitors due to their proven benefits in slowing CKD progression and reducing cardiovascular events.

Kanda et al.[34] reported that discontinuation or down-titration of RAS inhibitors therapy following an episode of hyperkalemia significantly increased the risk of progression to end-stage kidney disease (ESKD) and cardiovascular complications compared to patients who maintained or up-titrated therapy. A viable strategy to address this issue involved managing hyperkalemia while maintaining RAS inhibitor therapy. Studies demonstrated that patients with CKD or heart failure treated with the potassium binder sodium zirconium cyclosilicate (SZC) after experiencing hyperkalemia were significantly more likely to sustain RAS inhibitor therapy for six months, highlighting the role of potassium binders in supporting optimal RAS inhibitor use[35].

Accordingly, the KDIGO CKD guideline recommended avoiding premature discontinuation of RAS inhibitors. Instead, the guideline suggested implementing strategies such as dietary modification, adjustment of concomitant medications, and use of potassium-binding agents to manage hyperkalemia while preserving the benefits of RAS inhibitor therapy[36]. These insights underscore an urgent need to strengthen clinical protocols for hyperkalemia management at the hospitals in Chanthaburi Province.

Regional disparities in hyperkalemia prevalence within Chanthaburi Province were observed, with the highest prevalence noted in the Lamsing District. The population who are residing in the Eastern region of Chanthaburi Province may comprise and the first target population for exploring specific etiology of hyperkalemia. While the exact mechanisms driving these regional variations warrant further exploration, factors such as dietary practices, environmental exposures, and healthcare infrastructure may play pivotal roles. Understanding these regional nuances is crucial for tailoring targeted interventions and optimizing resource allocation to effectively address hyperkalemia in diverse geographical contexts.

The findings of the present study provide valuable data on the epidemiology and clinical implications of hyperkalemia among advanced CKD patients in Chanthaburi Province, Thailand. Furthermore, the study's exploration of regional

disparities in hyperkalemia prevalence helps to understand the geographical variations and emphasizes the importance of tailored approaches to address hyperkalemia within diverse populations.

However, there are limitations. Firstly, the study's single-center design may restrict the generalizability of the findings to broader populations.

Secondly, the exclusion of patients undergoing dialysis or those who had received KTs may further limit the applicability of the results to the full spectrum of CKD. These populations were intentionally excluded due to confounding factors that could independently influence serum potassium levels such as dialysis modality and adequacy, perioperative fluctuations, and immunosuppressive therapy. While this approach allowed for a more homogeneous assessment of risk factors in non-dialysis advanced CKD patients, it may have led to an underestimation of the overall prevalence of hyperkalemia compared with studies that include these high-risk groups.

Thirdly, the cross-sectional design limits the ability to establish causal relationships between identified risk factors and hyperkalemia. Additionally, the potential for information and recall bias may impact data accuracy and completeness. Moreover, the present study could not collect data on dietary habits and patient education levels, which might affect serum potassium control.

Lastly, the wide confidence interval observed for chronic heart failure reflects the limited number of patients with this condition in the non-hyperkalemia group. Although this reduces the statistical precision of the estimate, we retained this variable in the multivariable analysis due to its established clinical relevance as a confounder. Readers should interpret this finding with caution. Additionally, the small sample size of the present study, with 171 participants, may further limit the statistical power to detect subtle associations between multiple independent variables and hyperkalemia. This limitation is inherent to the retrospective design, as the sample size was determined by the number of eligible patients attending the CKD clinic during the predefined study period. While the findings provide valuable preliminary insights, caution is warranted when interpreting these results, particularly in terms of generalizability to larger or more diverse populations. Future studies involving larger, multi-center cohorts are needed to confirm these associations and enhance the robustness of the findings.

Conclusion

In conclusion, the present study revealed a high prevalence of hyperkalemia among advanced CKD patients in Chanthaburi Province, Thailand. Independent risk factors for hyperkalemia identified in this study were chronic heart failure and eGFR less than 8 mL/minute/1.73 m^2. The exploration of regional disparities in hyperkalemia prevalence emphasized the importance of tailored approaches to address this condition within diverse populations.

What is already known about this topic?

The prevalence of hyperkalemia is elevated among patients with advanced CKD. However, there exists a paucity of evidence concerning its prevalence and associated risk factors in specific geographical regions, such as Chanthaburi Province, Thailand, where a plethora of potassium-rich fruits are prevalent.

What does this study add?

The authors observed the high prevalence of hyperkalemia among advanced CKD patients in Chanthaburi Province. This study's investigation into regional disparities in hyperkalemia prevalence enhances our comprehension of geographical variations and emphasizes the significance of customized approaches to managing hyperkalemia across diverse populations in Chanthaburi Province.

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Conflicts of interest

The authors declare no conflicts of interest.

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