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A Retrospective Analysis of Patients Presenting with Acute Hyperkalemia in an Emergency Care Setting

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Objective: We aimed to analyze the clinical characteristics and prognostic factors of patients with severe hyperkalemia in the emergency department.

Methods: This retrospective cohort study included adult patients diagnosed with severe hyperkalemia who sought medical care at the emergency department of Aerospace Center Hospital between January 2018 and May 2022. Clinical data, including demographics, comorbidities, laboratory findings, and outcomes, were systematically collected. Patients were categorized into survival and deceased groups based on in-hospital mortality. Comparative analysis between these groups identified significant differences, highlighting key clinically covariates. Binary logistic regression was employed to determine the primary factors influencing patient outcomes.

Results: Of 90 patients diagnosed with severe hyperkalemia, 64 were in the survival group, and 26 in the deceased group. Binary logistic regression identified several significant predictors of mortality, including higher APACHE II scores (odds ratio [OR] 1.41, $P = 0.02$), widened QRS wave on electrocardiogram (ECG) (OR 79.39, $P = 0.04$), and elevated serum potassium levels (OR 1.3, $P = 0.04$). In contrast, emergency blood purification was associated with a reduced mortality rate (OR 0.29, $P = 0.03$).

Conclusion: Key risk factors for mortality in patients with severe hyperkalemia include widened QRS wave on ECG, elevated APACHE II score, and high serum potassium level. Timely correction of hyperkalemia through emergency blood purification significantly improves patient outcomes.

Keywords: clinical manifestation, prognosis, risk factors, severe hyperkalemia, treatment

Introduction

Potassium ions are essential electrolytes with critical roles in cellular metabolism, osmotic balance, acid-base homeostasis, neuromuscular excitability, and normal myocardial function.[1] Approximately 98% of the body's total potassium is located within intracellular fluid, while only 2% is present in extracellular fluid. Normal serum potassium levels range between 3.5 to 5.0 mmol/L.[2] Hyperkalemia, defined as a serum potassium level exceeding 5.0 mmol/L, can result from various factors, including renal insufficiency, excessive potassium intake, or a shift of potassium from intracellular to extracellular fluid. Severe hyperkalemia (serum $K^+ > 6.5$ mmol/L) is a dangerous electrolyte imbalance associated with life-threatening arrhythmias, such as ventricular fibrillation and asystole, which can lead to cardiac arrest. This condition carries a high risk of mortality requiring immediate recognition and intervention.[3]

Electrocardiographic monitoring and timely emergency medical interventions are critical in managing hyperkalemia.[4–7] The emergency department plays a crucial role in both the diagnosis and management of this condition, demanding that physicians be well-versed in its risk factors, clinical presentations, treatments strategies, and prognostic indicators.

The primary objective of this study was to identify the risk factors among patients presenting with hyperkalemia in the emergency department and to explore the relationship between serum potassium levels, initial laboratory findings, APACHE II scores, and in-hospital mortality rates.

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Materials and Methods

Study Population

This single-center retrospective group study encompassed patients aged 18 years or older who arrived at the emergency department of Aerospace Center Hospital between January 2018 and May 2022 and underwent emergency laboratory testing revealing serum potassium levels greater than or equal to 6.5 mmol/L. Inclusion criteria were established by querying the emergency electronic medical record system. Exclusion criteria comprised patients with pseudo-hyperkalemia and terminally ill patients who declined all forms of intervention and treatment (Figure 1). Approval for this study was obtained from the Ethics Committee of Aerospace Center Hospital, also known as Beijing Airlines Medical Ethics Review Committee (approval number: Beijing Airlines Medical Ethics Review 2022 No. 124). Given the retrospective nature of the study, informed consent was waived, and all clinical investigations adhered to the guidelines outlined in the *Declaration of Helsinki* 2008.

Data Collection

The relevant clinical data of patients were retrieved through an inquiry of the emergency electronic medical record system. These encompassed variables such as sex, age, underlying diseases (including hypertension, diabetes, coronary heart disease, cardiac insufficiency, renal insufficiency, and cerebrovascular disease), medications potentially associated with hyperkalemia (such as spironolactone, potassium chloride, angiotensin-converting enzyme inhibitors [ACEI], and angiotensin receptor blockers [ARB]), chief complaint upon presentation, and vital signs (comprising of body

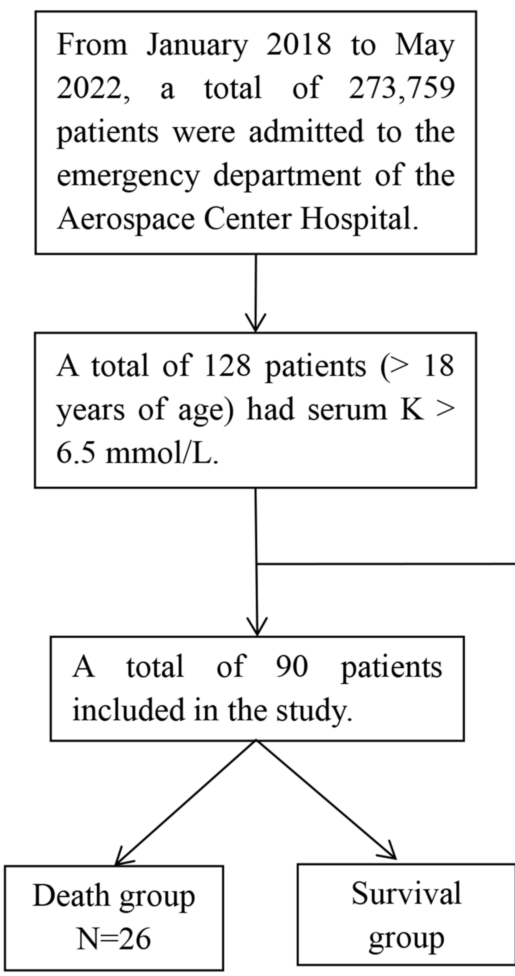

Figure 1 Patient enrollment process.

temperature, respiration rate, heart rate, mean arterial pressure, and peripheral oxygen saturation) at the initial visit. Additionally, data included results from initial tests (pH value, partial pressure of oxygen [PO_2], partial pressure of carbon dioxide [PCO_2], lactic acid [Lac], bicarbonate [HCO_3^-], brain natriuretic peptide [BNP], C-reactive protein [CRP], D-dimer, white blood cell count [WBC], hemoglobin [HB], platelet count [PLT], blood glucose [Glu], serum sodium [Na], serum potassium [K], blood urea nitrogen [BUN], and serum creatinine [Cr]). It also included severity scores assessed in the emergency room (such as APACHE II score and Glasgow coma scale [GCS]), initial electrocardiogram (ECG) findings, measures employed for potassium reduction (administration of potassium-lowering medications, emergency bedside blood purification), and prognosis (in-hospital mortality or discharge, time of in-hospital mortality), among others.

Hypertension is characterized by systolic blood pressure exceeding 130 mmHg or diastolic blood pressure surpassing 80 mmHg, or the use of antihypertensive medications. Diabetes is diagnosed in patients exhibiting a random blood glucose concentration exceeding 200 mg/dL, at least two fasting plasma glucose levels surpassing 126 mg/dL, or glycosylated hemoglobin levels exceeding 7.0%, or upon the administration of oral glucose-lowering agents or insulin therapy. Chronic renal insufficiency denotes a prior diagnosis of chronic renal insufficiency or sustained elevation in serum creatinine levels for over 3 months. Congestive heart failure is identified by New York Heart Association functional classification III or IV. End-stage malignancy is characterized by widespread metastasis of solid tumors throughout the body. In the emergency room, we used the APACHE II scoring system to assess the severity of each patient's condition. The highest and lowest values of each indicator during the first 24 hours were recorded, and the corresponding scores were assigned according to the criteria outlined in Table 1. The higher score was used in the analysis. The Glasgow coma scale (GCS) score was based on the initial assessment upon the patients' arrival in the emergency room. Medications potentially linked with hyperkalemia are those presently prescribed, and potassium-lowering medications include intravenous administration of calcium gluconate and loop diuretics, intravenous infusion of glucose coupled with insulin, intravenous infusion of sodium bicarbonate, and oral administration of calcium polystyrene sulfonate. Emergency bedside blood purification refers to blood purification conducted within two hours of hyperkalemia diagnosis.

Statistical Analysis

Categorical variables were described by frequency and proportion and juxtaposed using a chi-square test. Continuous variables were presented as mean ± standard deviation and compared using a *t*-test after verifying normality. Patients were divided into the death group and the survival group based on prognosis, whereupon comparisons were drawn across various parameters such as sex, age, underlying diseases, baseline medications, presenting symptoms, initial vital signs, initial examination findings, emergency room scores, ECG findings, and treatment methods to discern notable distinctions between the groups. Subsequently, statistically significant and clinically relevant covariates were identified for binary logistic regression analysis. To reduce multicollinearity, only one variable was selected from highly correlated

Table 1 Distribution of APACHE II Scores Among Patients with Severe Hyperkalemia

APACHE II scores	Quantity	Proportion
10~15	1	1%
15~20	20	20%
20~25	29	30%
25~30	22	20%
30~35	7	8%
35~40	4	4%
40~45	3	3%
45~50	3	3%
50~55	1	1%

variable sets for inclusion in the binary logistic regression model. A *P* value less than 0.05 was deemed statistically significant.

Results

Demographic and Clinical Baseline Characteristics

Between January 2018 and May 2022, the emergency department of a hospital attended to 273,759 patients, of whom 128 had serum potassium levels exceeding 6.5 mmol/L. After re-evaluation, 13 patients were diagnosed pseudo-hyperkalemia, and 25 were in terminal stage. As a result, 90 patients with severe hyperkalemia were included in the study, comprising 64 in the survival group and 26 in the death group (Table 2).

Among these patients, 48 were male (53.3%) with an average age of 71.1 years, showing no significant gender difference between groups. However, significant differences were found between the survival and death groups in several comorbidities, including hypertension (79.7% vs 34.6%, $p < 0.01$), type 2 diabetes mellitus (60.9% vs 34.6%, $p = 0.02$), and coronary heart disease (71.9% vs 38.5%, $p < 0.01$). No significant differences were observed in cardiac insufficiency, cerebrovascular diseases, chronic renal insufficiency, and regular dialysis (Table 3).

For chief complaints, impaired consciousness was more common in the death group (43.3%) compared to the survival group (14.1%) ($p = 0.003$). Upon initial presentation, significant differences were identified in respiratory rate, mean arterial pressure, and peripheral oxygen saturation between the groups: respiratory rate (22.11±5.93 vs 17.73±10.07, $p = 0.02$), mean arterial pressure (93.21±25.85 vs 64.32±40.05, $p < 0.001$), and peripheral oxygen saturation (92.9±17.88 vs 72.81±37.87, $p = 0.001$) (Table 3).

Laboratory tests also revealed significant differences between the survival and death groups: lactate (5.93±8.52 vs 10.94±11.57, $p = 0.04$), CRP (30.54±41.07 vs 84.57±63.77, $p < 0.001$), D-dimer (2.56±2.98 vs 6.03±3.68, $p = 0.01$), WBC count (12.69±10.09 vs 17.92±14.14, $p = 0.04$), and serum potassium (7.66±0.90 vs 7.89±0.99, $p = 0.02$) (Table 3).

In terms of severity scores, significant differences were observed in GCS scores (13.07 ± 3.18 vs 9.31 ± 4.54, $p < 0.001$) and APACHE II scores (23.21 ± 5.41 vs 29.5 ± 9.08, $p = 0.001$). On ECG, a significant difference was noted in the prevalence of widened QRS waves between the survival and death groups (15.6% vs 23.4%, $p = 0.04$) (Table 4).

Treatment and Prognosis in the Emergency Room of Patients

All enrolled patients received potassium-lowering therapy in the emergency room, with 88 patients (97.8%) undergoing glucose plus insulin treatment, 84 patients (93.3%) receiving sodium bicarbonate, and all patients receiving calcium gluconate. Also, 78 patients (74.4%) were administered diuretics, 26 (28.9%) received oral potassium-lowering resin, and 24 (26.7%) underwent emergency bedside blood purification therapy. Statistically significant differences were observed between the survival and death groups in the administration of calcium polystyrene sulfonate (35.9% vs 11.3%, $p = 0.02$) and emergency blood purification (35.9% vs 3.8%, $p = 0.003$).

Among the 90 enrolled patients, 64 patients (71.1%) were successfully discharged, including 6 patients discharged directly from the emergency room and 38 discharged following admission to the Intensive Care Unit (ICU) for further treatment. A total of 26 patients (28.9%) succumbed to the condition, with 11 deaths occurring in the emergency room and 15 deaths in the ICU (Table 3).

Table 2 Serum Potassium Distribution

Serum potassium range (mmol/L)	Number of patients (%)
6.5–7.4	41(45.6)
7.5–8.4	34(37.8)
8.5–9.4	10(11.1)
>9.4	5(5.5)

Table 3 Demographic and Clinical Baseline Characteristics

Characteristics	Total (percentage)/Mean ± standard deviation (n=90)	Survival group (n=64)	Death group (n=26)	*P* value
Male	48(53.3)	31(48.4)	11(42.3)	0.60
Age	71.1±14.8	70.33±15.01	71.88±14.84	0.757
Underlying diseases				
Hypertension	59(65.5)	51(79.7)	9(34.6)	<0.01
Type 2 diabetes mellitus	47(52.2)	39(60.9)	9(34.6)	0.02
Coronary heart diseases	55(61.1)	46(71.9)	10(38.5)	<0.01
Cardiac insufficiency	52(57.8)	41(64.1)	12(46.2)	0.12
Cerebrovascular diseases	16(17.8)	13(20.3)	3(11.5)	0.32
Chronic renal insufficiency	63(70)	48(75)	15(57.7)	0.08
Basic medications				
Spironolactone	23(25.6)	16(25.0)	7(26.9)	0.93
Potassium chloride extended-release tablets	40(44.5)	31(48.4)	9(34.6)	0.09
ACEI	24(26.7)	19(29.7)	5(19.2)	0.07
ARB	30(33.3)	22(34.4)	8(30.8)	0.78
Chief complaint for emergency department visits				
Dyspnea	34(37.8)	23(35.9)	11(42.3)	0.14
Nausea and vomiting	31(34.4)	21(32.8)	10(38.5)	0.61
Unconsciousness	20(22.2)	9(14.1)	11(43.3)	0.003
Fatigue	8(8.9)	8(12.5)	0	0.05
Palpitation	6(6.7)	5(7.8)	1(3.8)	0.49
Asymptomatic	5(5.5)	5(7.8)	0	0.14
Oliguria	4(4.4)	3(4.7)	1(3.8)	0.86
Respiratory and cardiac arrest	4(4.4)	0	4(15.4)	0.001
Edema	3(3.3)	3(4.7)	0	0.26
Vital signs at first visit				
Body temperature	36.4±0.7	36.36±0.40	36.30±1.09	0.501
Breathe	20.6±7.5	22.11±5.93	17.73±10.07	0.018
Heart rate	81.06±33.4	82.52±29.35	77.42±42.65	0.514
Mean arterial pressure	84.3±33.1	93.21±25.85	64.32±40.05	<0.001
Peripheral oxygen saturation	86.9±26.6	92.9±17.88	72.81±37.87	0.001
Results of first tests				
pH	7.2±0.2	7.19±0.18	7.13±0.32	0.11
PCO_2	29.3±12.1	28.83±14.04	29.43±21.21	0.60
PO_2	85.0±72.4	79.23±51.09	89.57±24.84	0.34
Lac	6.0±8.1	5.93±8.52	10.94±11.57	0.04
HCO_3	11.8±6.9	10.38±5.88	10.21±8.43	0.26
BNP	1565.5±1817.4	2008.47±2212.06	1238.14±1272.98	0.59
CRP	50.9±55.1	30.54±41.07	84.57±63.77	<0.001
D-dimer	2.6±3.1	2.56±2.98	6.03±3.68	0.01
WBC	14.1±11.6	12.69±10.09	17.92±14.14	0.04
HB	92.7±29.9	93.69±27.57	90.31±35.76	0.62
PLT	214.6±112.5	214.39±100.07	219.08±139.92	0.81
Glu	10.1±6.9	9.73±4.19	10.63±10.71	0.66
Na	134.1±7.6	134.63±7.57	133.38±8.07	0.53
K	7.7±0.9	7.66±0.90	7.89±0.99	0.02
BUN	30.5±16.8	31.39±16.73	29.13±17.81	0.62
Cr	496.4±368.6	540.38±408.01	383.93±236.39	0.06
Emergency score				

(*Continued*)

Table 3 (Continued).

Characteristics	Total (percentage)/Mean ± standard deviation (n=90)	Survival group (n=64)	Death group (n=26)	*P* value
GCS	11.8±4.1	13.07±3.18	9.31±4.54	<0.001
Apache II	25.3±7.5	23.21±5.41	29.5±9.08	0.001
First ECG finding				
Normal ECG	28(31.1)	21(32.8)	7(26.9)	0.20
Peaked T wave	16(17.8)	12(18.8)	4(15.4)	0.19
Widened QRS wave	25(27.8)	10(15.6)	15(57.7)	0.04
Sinus bradycardia	6(6.7)	4(6.3)	2(7.7)	0.65
Atrioventricular block	15(16.7)	10(15.6)	5(19.2)	0.62
Emergency treatment				
Glucose plus insulin	88(92.2)	62(96.8)	26(100)	0.76
Sodium bicarbonate	84(93.3)	60(93.8)	24(92.3)	0.80
Calcium gluconate	88(97.7)	64(100)	26(100)	1.00
Loop diuretics	78(86.7)	57(89.1)	21(80.8)	0.29
Calcium polystyrene sulfonate	26(28.9)	23(35.9)	3(11.5)	0.02
Emergency blood purification	24(26.7)	23(35.9)	1(3.8)	0.003

Abbreviations: ACEI, Angiotensin-Converting Enzyme Inhibitor; ARB, Angiotensin Receptor Blocker; Lac, Lactate; BNP, B-type Natriuretic Peptide; CRP, C-Reactive Protein; WBC, White Blood Cell; HB, Hemoglobin; PLT, Platelet; Glu, Glucose; BUN, Blood Urea Nitrogen; Cr, Creatinine; GCS, Glasgow Coma Scale; ECG, Electrocardiogram.

Table 4 ECG Findings in Patients with Hyperkalemia

ECG findings	Number of patients
Normal ECG	26
Peaked T wave	14
Intraventricular block	19
Sinus bradycardia	5
Atrioventricular block	13
Equipotential lines	4

Abbreviation: ECG, Electrocardiograph.

Relationship Between in-Hospital Mortality and Clinical Factors

To further assess the association between in-hospital mortality and clinical factors, univariable regression analysis was performed. As shown in Table 5, a history of diabetes, ACEI/ARB drug use, higher serum potassium, elevated Lac level, higher CRP level, increased D-dimer level, widened QRS wave, and higher APACHE II score were associated with higher mortality. Conversely, early blood purification treatment was associated with lower mortality rates. Although statistical analysis suggested that a history of hypertension, low respiratory rate, low mean arterial pressure, and low peripheral oxygen saturation were linked to lower mortality, these findings are more likely influenced by confounding bias from a clinical perspective. Based on both clinical relevance and the results of the above univariate regression analysis, we selected a history of diabetes, serum potassium levels, QRS waveform width, APACHE II score, and emergency blood purification as covariates for multivariate regression analysis. The results indicate that while a history of diabetes had a p-value of 0.059-falling short of statistical significance-this may be attributed to the limited sample size and potential multicollinearity (Table 6).

Table 5 Univariable Regression Analysis Indicates a Correlation Between in-Hospital Mortality and Clinical Factors

Items	OR	95% confidence interval for OR		Significance
		Lower limit	Upper limit	
Hypertension	0.15	0.01	0.97	0.01
Diabetes	3.453	1.293	9.221	0.013
ACEI/ARB drug	8.333	1.044	66.525	0.045
Breathe	0.922	0.859	0.990	0.025
Mean arterial pressure	0.980	0.968	0.992	0.001
Peripheral blood oxygen saturation	0.974	0.955	0.993	0.007
Serum potassium	1.3	1.03	2.12	0.04
Lac	1.059	1.001	1.120	0.046
CRP	1.025	1.011	1.038	0.000
CRP	1.025	1.011	1.038	0.000
d-dimer	1.207	1.034	1.409	0.017
Widened QRS wave	79.39	12.90	6685.16	0.001
Apache II	1.41	1.05	1.90	0.02
Emergency blood purification	0.29	0.01	0.91	0.03

Table 6 Prognostic Factors in Severe Hyperkalemia

	B	P	OR	95% confidence interval for OR	
				Lower limit	Upper limit
Apache II	0.091	0.017	1.095	1.017	1.179
Serum potassium	−0.013	0.033	0.987	0.625	0.996
Widened QRS wave	−1.151	0.037	0.316	0.088	0.965
Diabetes	1.038	0.059	2.822	0.960	8.295
Emergency blood purification	−0.716	0.049	1.489	1.144	1.653
Constant	−2.651	0.325	0.071		

Discussion

This study conducted a retrospective analysis encompassing clinical presentations, ECG findings, laboratory results, diagnosis and treatment, and prognostic outcomes among patients diagnosed with severe hyperkalemia in the emergency department. Also, regression analysis was conducted to clarify various clinical factors associated with mortality.

Between January 2018 and May 2022, a total of 90 patients received a diagnosis of severe hyperkalemia, representing an incidence of 0.03%, a figure notably lower than those reported internationally. For instance, a Swiss university hospital reported a prevalence of hyperkalemia among emergency department patients at 0.3% (defined as serum or plasma potassium concentration ≥ 6 mmol/L).[8] Among the study group, 26 patients succumbed in-hospital, yielding a mortality rate of 28.9%, similar to findings from a 2012 study conducted in South Korea, which reported a mortality rate of 30.7% for severe hyperkalemia.[9] Chronic renal insufficiency emerged as the predominant underlying condition associated with severe hyperkalemia, with 70% of affected patients presenting a history of chronic kidney disease, and 23.3% undergoing regular dialysis therapy.[10] These findings align with prior literature, underscoring the significance of serum potassium monitoring in patients with chronic renal insufficiency upon admission to emergency care settings.

In this study, medications potentially associated with hyperkalemia were analyzed. A notable proportion, ranging between 25% and 40% of patients, had a documented history of oral medications linked to an increased risk of hyperkalemia. Primarily, these medications encompassed spironolactone, potassium chloride extended-release tablets, and ACEI/ARB antihypertensive drugs, findings that align with previous research.[11]

In this study, patients diagnosed with severe hyperkalemia exhibited a variety of clinical manifestations lacking distinctive specificity. Predominantly, dyspnea, gastrointestinal symptoms, and impaired consciousness emerged as the primary presenting complaints. In contrast to findings reported in the literature, only a few patients demonstrated muscle and cardiac symptoms, such as fatigue and palpitations, with 5.5% of patients being entirely asymptomatic, incidentally discovered during the examination.[12] Notably, the proportion of impaired consciousness was higher in the death group compared to the survival group (14.1% vs 43.3%, $P = 0.003$), revealing a potential association between complications with other critical diseases and heightened mortality risk in patients with hyperkalemia.

In this study, the initial laboratory findings following hospital visits revealed distinctive characteristics among patients, including pronounced metabolic acidosis (pH 7.2 ± 0.2, lactate 6.0 ± 8.1, bicarbonate 11.8 ± 6.9). Acute infections were prevalent in most patients, as evidenced by significantly elevated CRP and WBC levels. Also, significant changes in serum creatinine and blood urea nitrogen were observed (blood urea nitrogen 30.5 ± 16.8, creatinine 496.4 ± 368.6). When comparing the test results between the survival and death groups, it was evident that serum lactate levels, WBC count, CRP, and D-dimer were significantly higher in the death group, indicating a potential association between clinical comorbidities such as metabolic acidosis, infection, and coagulation dysfunction, and increased mortality risk in patients with toxic hyperkalemia.[13]

This study observed diverse ECG findings among patients diagnosed with severe hyperkalemia, consistent with previous research.[14–16] These findings encompassed peaked T waves, widened QRS waves, and sinus bradycardia. Notably, a substantial proportion of patients (31.1%) exhibited a normal ECG, underscoring the potential for misdiagnosis of hyperkalemia based solely on ECG findings. Also, the study identified widened QRS waves on ECG as a significant risk factor for death among patients with severe hyperkalemia.[17] The shape and width of the QRS complex reflect the ventricular depolarization process and the integrity of the conduction system, including the His-Purkinje fibers. Severe hyperkalemia inactivates some voltage-gated sodium channels, shortening the depolarization phase and diminishing the upstroke and amplitude of the action potential. This leads to prolonged depolarization, conduction delays, and, in severe cases, conduction block. Sustained depolarization can also impact the function of L-type calcium channels, thereby impairing myocardial contractility. These electrophysiological changes significantly increase the risk of mortality in affected patients.

Nearly all patients included in this study received conventional potassium-lowering medications, such as calcium gluconate, glucose plus insulin, sodium bicarbonate, and loop diuretics.[18] However, only 28.9% of patients received the potassium-lowering agent calcium polystyrene sulfonate, with a notably higher proportion observed in the survival group when compared to the death group. This discrepancy may be attributed to factors such as the prevalence of nausea, vomiting, or critical diseases among patients, rendering them unable to tolerate oral potassium-lowering medications. Emergency blood purification was administered to only 26.7% of patients, potentially influenced by factors such as the availability of medical resources, variations in the responses of patients to potassium-lowering medications, and the preferences of the families of patients regarding invasive treatments. Notably, the proportion of emergency blood purification was significantly higher in the survival group when compared to the death group (35.9% vs 3.8%, $p = 0.003$), revealing its potential role in reducing mortality risk among patients with hyperkalemia and emphasizing its importance in managing critically ill patients.[19]

To further clarify the relationship between clinical factors and mortality, we performed univariate regression analysis on all relevant variables. Based on the results of this analysis and their clinical significance, we selected a history of diabetes, serum potassium levels, widened QRS wave, APACHE II score, and emergency blood purification as covariates for multivariate regression analysis. The results revealed that widened QRS wave, increased APACHE II score, and increased serum potassium level emerged as primary risk factors for mortality in patients with severe hyperkalemia. Conversely, those who underwent emergency blood purification during hospitalization exhibited a reduced risk of death. APACHE II score served as a valuable tool for assessing mortality risk among patients with severe hyperkalemia in this study.

This study is subject to several limitations: 1) Inclusion was limited to patients with severe hyperkalemia, before the analysis of the clinical characteristics and prognosis of patients with mild hyperkalemia as a control group. 2) The retrospective nature of this group study, coupled with a small sample size may introduce statistical bias. 3) Analysis was restricted to the initial tests and ECGs upon admission, without providing descriptions of subsequent changes and the dynamic evolution process. Additionally, details regarding rescue interventions such as tracheal intubation and the administration of vasoactive drugs were not provided. 4) Only medications potentially contributing to renal insufficiency were considered, neglecting a comprehensive analysis of all medications taken by patients, potentially introducing bias.

Conclusion

Emergency department physicians should prioritize the identification and management of severe hyperkalemia, as patients often present with renal and cardiac insufficiency alongside infections, lacking distinctive clinical features. Key risk factors associated with increased mortality include a widened QRS wave on ECG, elevated APACHE II score, and high serum potassium levels. The prompt implementation of emergency blood purification can effectively correct hyperkalemia, offering significant benefits to patients.

Abbreviations

OR, odds ratio; CRP, C-reactive protein; GCS, Glasgow Coma Scale; ACEI, Angiotensin-Converting Enzyme Inhibitors; ARB, Angiotensin Receptor Blockers; BNP, brain natriuretic peptide; Lac, lactic acid; WBC, White Blood Cells; HB, hemoglobin; PLT, Platelets; BUN, Blood Urea Nitrogen; Cr, creatinine.

Ethics Approval and Consent to Participate

This study was conducted with approval from the Ethics Committee of Aerospace Center Hospital / Beijing Airlines Medical Ethics Review Committee (Approval Number: Beijing Airlines Medical Ethics Review 2022 No. 124). This study was conducted in accordance with the declaration of Helsinki.

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Disclosure

The authors declare that they have no competing interests.

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