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The Relationship Between Sodium (Na^+), Potassium (K^+), and Chloride (Cl^-) Electrolyte Disorders and Clinical Conditions in Elderly Patients in the Emergency Room of Yarsi Hospital for the Period January to December 2023

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Abstract

Elderly patients are prone to electrolyte balance disorders due to aging, decreased organ function, hormonal changes, and high comorbidities. Imbalances of sodium, potassium, and chloride can affect neurological, muscle, and cardiovascular function, thus contributing to clinical instability in the emergency room. This study is an observational study of cross-cutting design analysis based on secondary data of medical records. The subject is an elderly patient (≥60 years old) who underwent an electrolyte examination at the Yarsi Hospital Emergency Room for the January-December 2023 period. Of the 1,730 visits, 315 patients met the inclusion criteria. The variables analyzed included sodium, potassium, chloride levels, as well as characteristics of age, sex, and clinical condition upon admission. Univariate and bivariate analysis was performed using the Chi-Square test. The majority of subjects were early elderly women. Hyponatremia is the most frequent disorder, followed by hypokalemia and hypochloremia. A total of 53% of patients experienced one electrolyte disorder, 36.2% two disorders, and 10.8% three disorders at once. The most common clinical conditions are low intake, chronic kidney disease, diabetes mellitus, infection, CVDNH, and vomiting. The Chi-Square test showed a significant association between clinical conditions and sodium (p=0.029), potassium (p=0.038), and chloride (p=0.027) impairments. Electrolyte disorders in the elderly in the emergency room are significantly related to the patient's clinical condition. Hyponatremia is most dominant and is associated with poor intake, chronic kidney disease, infections, and diabetes.

INTRODUCTION

The balance of electrolytes in the blood is a fundamental component in maintaining the integrity of the body's metabolic processes, because the stability of the concentration of these ions is necessary to ensure that physiological functions run in a coordinated manner. Blood electrolytes consist of compounds that dissociate into positively and negatively charged ions,

each of which plays a role in bioelectrical activity, osmolality regulation, and neuromuscular and cardiovascular functions. The balance between these various ions, known as electronalis, plays a central role in maintaining the body's homeostasis. Irregularities in electronalis can interfere with essential physiological mechanisms and potentially lead to significant medical complications (Xiao et al., 2024)

One of the important aspects of maintaining homeostasis is the regulation of electrolyte balance, specifically sodium (Na^+), potassium (K^+), and chloride (Cl^-), since these three ions play a direct role in regulating the volume and osmolarity of extracellular fluids (ECF). The concentration of sodium as the main cation of ECF greatly determines the osmotic pressure and distribution of fluids between compartments, so small changes in its levels can affect physiological stability, especially in elderly patients. The regulation of such electrolyte concentrations is highly dependent on the function of the kidneys, which controls the processes of glomerular filtration, tubular reabsorption, and excretion through hormonal mechanisms. The hypothalamic osmorereceptor system, vascular baroreceptor, and renin–angiotensin–aldosterone system (RAAS) work together to maintain a balance of sodium, potassium, and chloride. In the distal tubules and collective ducts, aldosterone increases sodium reabsorption and potassium excretion, while chloride is absorbed through electrochemical mechanisms that run in parallel to maintain acid-base balance and overall electrolyte stability (Palmer, 2022)

As we age, there are various physiological changes that have a direct impact on the body's ability to maintain electrolyte homeostasis. One of the most significant changes is a decrease in kidney function, which affects the process of excretion and reabsorption of sodium and potassium. In the elderly, the kidneys experience structural and functional degeneration, including a decrease in glomerular filtration rate (GFR), a decrease in the number of functional nephrons, and a decrease in the ability of the tubules to concentrate and dilute urine. This condition causes electrolyte regulation to be less efficient and increases the risk of hyponatremia, hypernatremia, hypokalemia, and hyperkalemia. In addition, the elderly are more prone to dehydration due to decreased thirst, changes in the body's response to osmoality, and reduced adaptability to fluid stress. The combination of these factors makes the elderly group more susceptible to electrolyte balance disorders and the accompanying clinical complications (Fang et al., 2020) .

Hypernatremia, which is a condition of increased serum sodium levels above 145 mmol/L, is one of the electrolyte disorders that are often found in elderly patients. Elderly people with cognitive impairment, mobility limitations, or high dependence on meeting daily needs have a greater risk of developing hypernatremia. This condition generally starts from reduced thirst, inadequate fluid intake, and decreased ability of the kidneys to thicken urine along with the aging process. It is noted that the elderly group with dementia or other conditions that cause chronic dehydration are more susceptible to hypernatremia which can lead to neurological and hemodynamic disorders. (Switzerland , 2021)

On the other hand, hyponatremia, which is a decrease in serum sodium levels below 135 mmol/L, is one of the most common electrolyte disorders found in geriatric practice. In the elderly age group, hyponatremia is usually multifactorial. This condition can be triggered by increased secretion of antidiuretic hormones, the use of medications such as diuretics or antidepressants, as well as comorbidities that cause water retention. It is also reported that hyponatremia in the elderly is closely related to cognitive impairment, increased risk of falls,

instability of walking, and high mortality rates compared to younger age groups. (Switzerland , 2021)

Disorders in other electrolytes, such as potassium and chloride, are also common in the elderly. Potassium imbalances in both hypokalemia and hyperkalemia are generally associated with decreased kidney function, the use of certain medications such as diuretics and ACE inhibitors, as well as chronic diseases such as heart failure and diabetes. It also emphasizes that changes in potassium levels can cause neuromuscular disorders to potentially life-threatening arrhythmias. Meanwhile, chloride disorders, especially hypochloremia, are often associated with acid-base imbalances and worsening of clinical conditions in patients with acute and chronic diseases. Overall, this combination of sodium, potassium, and chloride disorders suggests that the elderly group is a highly susceptible population to electrolyte instability that can have a significant impact on their clinical condition. (Sardinha et al., 2022) (Benzing, 2021)

Epidemiological data show that there have been fluctuations in the incidence of hospitalizations due to fluid balance disorders over the past decade. In a study involving 259,607 patients in primary clinics and tertiary hospitals, the incidence of hospitalization due to excess fluids decreased from 2.99% in 2013 to 2.18% in 2017, but again increased to 3.71% in 2022 Electrolyte balance disorders can worsen the prognosis of underlying diseases, prolong the duration of treatment, and increase the cost of medical care. From an Islamic perspective, maintaining the stability of physical condition is part of the mandate to maintain health as recommended by the sharia. The balance of electrolytes as one of the important elements in the continuity of bodily functions can be seen as part of the effort to maintain (Tan et al., 2024) *hifz al-nafs* or the protection of the soul, which is one of the main goals *of Maqāṣid al-Syarī'ah* (Mat Salleh et al., 2022) .

Based on this background, and taking into account the significant negative impact on elderly patients with electrolyte balance disorders, researchers took the initiative to conduct a study to determine the relationship between electrolyte balance disorders of sodium (Na+), potassium (K+), and chloride (Cl-) in elderly patients treated at the emergency room of YARSI Hospital in the period January to December 2023.

Based on the background that has been written above, the formulation of the problem of this study is the relationship between Sodium (Na^+), Potassium (K^+), and Chloride (Cl^-) Electrolyte Disorders with Clinical Conditions in Elderly Patients in the Emergency Room of YARSI Hospital for the Period January to December 2023.

Research Questions 1) Is there a relationship between comorbid disease factors and electrolyte balance disorders of sodium (Na+), potassium (K+), and chloride (Cl^-) in elderly patients who came to the emergency room of Yarsi Hospital during the period January to December 2023? 2) What type of electrolyte disorder is most common in elderly patients in the emergency room of Yarsi Hospital? 3) What is the distribution of the prevalence of electrolyte disorders in elderly patients in the emergency room of Yarsi Hospital if grouped by gender? 4) What are the most common clinical conditions found in patients with electrolyte balance disorders of sodium (Na+), potassium (K+), and chloride (Cl^-) disorders in elderly patients who come to the emergency room of Yarsi Hospital? 5) How can the principles *of Maqāṣid al-Syarī'ah*, especially *Hifz an-Nafs*, be used as a basis in an effort to maintain electrolyte balance in the elderly?

Research Objectives Determining the Relationship between Sodium (Na^+), Potassium (K^+), and Chloride (Cl^-) Electrolyte Disorders with Clinical Conditions in Elderly Patients in the Emergency Room of YARSI Hospital for the Period January to December 2023. 1) Identifying the relationship between sodium (Na+), potassium (K+), and chloride (Cl^-) electrolyte disorders in elderly patients in the emergency room of Yarsi Hospital based on medical record data in the January–December 2023 period. 2) To find out the types of electrolyte disorders that most often occur in elderly patients in the emergency room of Yarsi Hospital based on medical record data in the January–December 2023 period. 3) Determine risk factors, such as gender, age, and comorbidities in elderly patients with electrolyte disorders in the emergency room of Yarsi Hospital based on medical record data in the January-December 2023 period.

RESEARCH METHODS

This study uses a type of analytical observational quantitative research with *a cross-sectional* design that aims to determine the relationship between Sodium (Na^+), Potassium (K^+), and Chloride (Cl^-) Electrolyte Disorders with Clinical Conditions in elderly patients in the YARSI Hospital Emergency Room based on medical record data.

This study was designed as a retrospective study, i.e. data was collected from the medical records of previously treated patients, i.e. during the period January to December 2023, to analyze the relationship between clinical conditions and electrolyte balance disorders.

The population in this study is elderly patients (≥60 years old) who were treated in the emergency room of YARSI Hospital during the period from January to December 2023.

Sample

Elderly patients (≥60 years old) who were treated at the YARSI Hospital emergency room during the January-December 2023 period.

a. Inclusion Criteria

- Patient with > age 60 years in the emergency room of YARSI Hospital.
- Patients with laboratory test results of electrolyte levels include Sodium (Na+), Potassium (K+), and Chloride (Cl^-) levels.

b. Exclusion Criteria

- Patients with medical record data without laboratory examination.
- Patients who come in terminal conditions with a poor prognosis.

Determination of Sample Quantity

In this study, the determination of the number of samples in elderly patients treated in the Emergency Facility (IGD) in the period from January to December 2023 was calculated using the Lemeshow formula.

$$n_0 = \frac{z^2.P\ (1-P)}{E^2}$$

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

n = Required sample size

Z = Confidence level (95%, Z = 1.96)

P = Proportion of the estimated population (P = 0.5)

E = Margin of error (E = 5% or 0.05)

The determination of the number of samples in this study used the *Lemeshow* Formula for proportions with a confidence level of 95%, Finite *Population Correction was carried out* with the total known population (N = 1,730). Based on the calculation above, the final sample size was obtained as many as 315 patients.

Data Type

This study uses secondary data obtained from the medical records of elderly patients who were treated in the Emergency Installation (IGD) of YARSI Hospital during the period January to December 2023. The data used in the study is quantitative, in the form of numbers that describe electrolyte levels, such as sodium (Na+), potassium (K+), and chloride (Cl-) measured in certain units (mmol/L).

Data Collection

Medical records of elderly patients who carried out laboratory examinations of electrolyte levels at the emergency room of YARSI Hospital during the January-December 2023 period.

Data Measurement

The data measurement in this study was focused on the results of laboratory examinations of electrolyte levels of sodium (Na+), potassium (K+), and chloride (Cl-) in elderly patients who were treated at the Emergency Installation (IGD) of YARSI Hospital. The data collected through the medical records will be measured in appropriate units, namely mmol/L (millimoles per liter), which is the standard unit for measuring electrolyte levels in the blood.

Electrolyte levels are checked through standardized laboratory blood tests at YARSI Hospital. The values obtained from this test will be used to determine if the patient has electrolyte balance disorders, such as hyponatremia, hyperkalemia, and others. In addition, patient demographic data, such as age and gender, will also be measured in the form of quantitative numerical data (age in years) and qualitative categorical data for gender (male/female).

Data Collection Instruments

The research instrument used was a data recording form that included the results of laboratory examinations and patient demographic information, such as age, gender, clinical diagnosis and comorbidities.

Data Analysis

The data collected in this study was analyzed through two stages, namely univariate analysis and bivariate analysis. Univariate analysis was used to describe the characteristics of each study variable, such as age, sex, clinical diagnosis, and distribution of sodium, potassium, and chloride levels. The results of this analysis are presented in the form of frequency and percentage tables.

Bivariate analysis was performed to assess the relationship between electrolyte balance disorders (sodium, potassium, and chloride) and the patient's clinical condition. The statistical test used is the Chi-Square (χ^2) test to find out whether there is a statistically significant relationship between two variables.

Research Hypothesis

The research hypothesis was developed to test the relationship between the clinical condition of patients and electrolyte balance disorders (sodium, potassium, and chloride) in elderly patients in the emergency room of Yarsi Hospital.

General Hypotheses

- H_0 (Null Hypothesis): There was no association between the patient's clinical condition and electrolyte (sodium, potassium, and chloride) impairment in elderly patients in the ERD of YARSI HOSPITAL.
- H_1 (Alternative Hypothesis): There is an association between the clinical condition of patients with electrolyte disorders (sodium, potassium, and chloride) in elderly patients in the EMERGENCY ROOM OF YARSI HOSPITAL.

RESULTS AND DISCUSSION

Results of General Description of the Research

Based on the results of medical record data on elderly patients at the YARSI Hospital emergency room during the January-December 2023 period, a total of 1,730 patients came to receive emergency services. Of the total population, 315 patients were designated as research samples based on calculations using the Lemeshow formula, so that the sample was considered representative enough to describe the characteristics of the elderly who came to the emergency room. All samples met the inclusion criteria, including the availability of complete electrolyte laboratory examination data upon arrival at the emergency room. The sample was then analyzed based on the main variables of the study, namely sodium content (Na^+), potassium content (K^+), chloride content (Cl^-), and their relationship with patient characteristics such as gender, age, and accompanying clinical conditions.

The results of the study regarding the relationship between sodium (Na^+), potassium (K^+), and chloride (Cl^-) electrolyte disorders with clinical conditions in advanced patients were obtained as follows:

Results of Characteristics of Elderly Patients in the YARSI Emergency Room

Table 1 Distribution of Elderly Patients with Electrolyte Disorders by Gender

Gender	Frequency	Present (%)
Women	170	54.0%
Male	145	46.0%
Total	**315**	**100**

The results of univariate data analysis showed that 170 patients with electrolyte disorders were female (54.0%) and 145 male patients (46.0%).

Table 2 Distribution of Elderly Patients with Electrolyte Disorders Based on WHO Age Category

Age of the elderly	Frequency	Present (%)
Early Elderly	249	79.0%
Old Age	65	20.6%

Very Old Elderly	1	0.3%
Total	**315**	**100**

Based on Table 2, the majority of elderly patients with electrolyte disorders who came to the emergency room of Yarsi Hospital in 2023 were in the Early Elderly category (60–69 years), which was 249 patients (79.0%). The Elderly group (70–79 years) recorded 65 patients (20.6%), while the Very Elderly group (≥80 years) was the category with the least number, which was only 1 patient (0.3%). These results show that electrolyte balance disorders are most often experienced by the 60–69 age group compared to other elderly people.

Table 3 Distribution of elderly patients by Total Types of Electrolyte Abnormalities

Categories Electrolyte Disorders	Frequency	Present (%)
On a single Parameter	167	53.0%
On Two Parameters	114	36.2%
On Three Parameters	134	10.8%
Total	**315**	**100**

In Table 3, the results show that most elderly patients have disturbances in only one electrolyte parameter, namely 167 patients (53.0%). A total of 114 patients (36.2%) were recorded to have disturbances in two electrolyte parameters, while patients with abnormalities in three electrolyte parameters were recorded as many as 34 people (10.8%). This distribution shows that electrolyte disorders in geriatric patients do not only occur as a single disorder, but the proportion of multiparameter disorders is also quite large and has the potential to have an impact on the patient's clinical condition.

Distribution of Clinical Conditions in Elderly Patients in the Emergency Room

Based on the results of the processing of medical record data of elderly patients who came to the emergency room of YARSI Hospital during the January-December 2023 period, it was obtained that intake disorders (low intake) were the most common comorbidities, which were found in 50 patients (25.9%). The next most frequent comorbid was chronic kidney disease (CKD) which was recorded in 49 patients (25.4%). Furthermore, blood sugar abnormalities that include glucose disorders and diabetes mellitus were found in 35 patients (18.1%), followed by infections in 23 patients (11.9%). Comorbid *non-hemorrhagic cerebrovascular disease* (CVDNH) was recorded in 19 patients (9.8%), and complaints of vomiting (vomiting) were found in 17 patients (8.8%). In addition, other comorbid categories that were not included in the main group amounted to 122 patients with a proportion of 38.7%, reflecting the variation of other comorbid conditions in the population.

Table 4 Distribution of 6 Most Disease Diagnoses in Elderly Patients

Authoritative Diseases	Frequency	Present (%)
Infection	57	18.0%
Low Intake	53	16.8%

CKD	47	14.9%
DM	35	11.1%
CVDNH	20	6.3%
Vomit	19	6.0%
Others	85	26.9
Total	**315**	**100%**

Overview of Sodium Level (Na^+) Categories in Elderly Patients (Based on Emergency Room Medical Record Data)

Based on the medical records of elderly patients in Table 4.6, as many as 61 patients (26.4%) had sodium levels within normal limits. Most of the patients experienced sodium disorders in the form of hyponatremia, which was 159 patients (68.8%), while hypernatremia was found in 11 patients (4.8%).

In the clinical condition group, hyponatremia was most commonly found in patients with infection (84.2%), followed by low intake (71.7%) and DM (77.1%). The condition of CKD showed a more balanced distribution between normal sodium (44.7%) and hyponatremia (48.9%). Hypernatremia was most commonly found in the CKD (6.4%) and low intake (3.8%) groups, while the infection and vomiting groups showed no cases of hypernatremia.

Table 5 Results of the distribution of sodium levels (hyponatremia, Normonatremia, Hypernatremia) in elderly patients

Categories	Frequency	Present (%)
Hyponatrix	210	66.7%
Normal	92	29.2%
Hypersodium	13	4.1%
Total	**315**	**100**

Table 6 Results of Sodium Distribution and Their Relationship with the Patient's Clinical Condition

Clinical Conditions	Normal Sodium Status	Hyponatrix	Hypersodium	Total
Infection	9 (15.8.%)	48 (84.2%)	0 (0.0%)	57 (100%)
Low Intake	13 (24.5%)	38 (71.7%)	2 (3.8%)	53 (100%)
CKD	21 (44.7%)	23 (48.9%)	3 (6.4%)	47 (100%)
DM	7 (20.0%)	27 (77.1%)	1 (2.9%)	35 (100%)
CVDNH	5 (25.0%)	10 (50.0%)	5 (25.0%)	20 (100%)
Vomit	6 (31.6%)	13 (68.4%)	0 (0.0%)	19 (100.0%)
Total	**61 (26.4%)**	**159 (68.8%)**	**11 (4.8%)**	**213 (100%)**

Table 7 Results of the Analysis Test *Chi-Square* Sodium Levels and Its Relationship to the Patient's Clinical Condition

Variable	X2	df	p-value
Comorbid X Sodium Status	12.500	5	0.029

5.2 Overview of Potassium Level Categories (K^+) in Elderly Patients (based on emergency room medical record data)

Based on Table 4.8, out of a total of 315 patients, most had potassium levels within normal limits, i.e. 199 patients (63.2%). Patients with hypokalemia were recorded as many as 87 patients (27.6%), while hyperkalemia was found in 29 patients (9.2%).

In Table 4.9, the distribution of potassium levels by clinical condition shows that normokalemia is most prevalent in the infection (64.9%), DM (74.3%), and CVDNH (75.0%) groups. Hypokalemia was mainly found in the low intake (39.6%) and CKD (36.2%) groups, while hyperkalemia was most commonly seen in the CKD (19.1%) and CVDNH (5.0%) groups. Overall, there were 140 patients (60.6%) with normal potassium, 71 patients (30.7%) with hypokalemia, and 20 patients (8.7%) with hyperkalemia in distribution based on clinical conditions.

Table 8 Results of Distribution of Potassium Levels (Hyponapotassium, Normopotassium, Hyperpotassium) in elderly patients

Categories	Frequency	Present (%)
Hypokalemia	87	27.6%
Normal	199	63.2%
Hyperkalemia	29	9.2%
Total	**315**	**100**

Table 9 Results of Potassium Distribution and Their Relationship with the Patient's Clinical Condition

Clinical Conditions	Norms	Hypopotassium	Hyperpotassium	Total
Infection	37 (64.9%)	16 (28.1%)	4 (7.0%)	57 (100%)
Low Intake	28 (52.8%)	21 (39.6%)	4 (7.5%)	53 (100%)
CKD	21 (44.7%)	17 (36.2%)	9 (19.1%)	47 (100%)
DM	26 (74.3%)	8 (22.9%)	1 (2.9%)	35 (100%)
CVDNH	15 (75.0%)	4 (20.0%)	5 (5.0%)	20 (100%)
Vomit	13 (68.4%)	5 (26.3%)	1 (5.3%)	19 (100.0%)
Total	**140 (60.6%)**	**71 (30.7%)**	**20 (8.7%)**	**213 (100%)**

Table 10 Results of the Analysis Test *Chi-Square* Potassium Levels and Their Relationship to Patients' Clinical Conditions

Variable	X2	df	p-value
Comorbid X Potassium Status	11.742	5	0.038

Overview of Chloride Levels (Cl^-) Categories in Elderly Patients (based on emergency room medical record data)

Based on the medical records of elderly patients in Table 4.10, out of a total of 315 patients, most of them had normal chloride levels of 158 patients (50.2%). Patients with hypochloremia were recorded as many as 72 patients (22.9%), while hypercholemia was found in 85 patients (27.0%).

In Table 4.11, the distribution of chloride levels by clinical condition shows that normochloremia was most prevalent in the CKD group (68.1%), followed by Vomit (63.2%) and DM (54.3%). Hypochloremia was mainly found in the low intake (41.5%) and infectious (33.3%) groups, while hypercholemiaa was most commonly seen in the CVDNH (45.0%) and CKD (23.4%) groups. Overall, 117 patients (50.6%) with normal chloride levels were recorded, 59 patients (25.5%) with hypochloremia, and 55 patients (23.8%) with hypercholemia.

Table 11 Results of Chloride Distribution (Hyponachloremia, Normochloremia, Hyperchloremia) in elderly patients

Categories	Frequency	Present (%)
Hypochloremia	72	22.9%
Normal	158	50.2%
Hyperchloremia	85	27.0%
Total	**315**	**100**

Table 12 Results of Chloride Distribution and Their Relationship with the Patient's Clinical Condition

Clinical Conditions	Norms	Hypochloremia	Hyperchloremia	Total
Infection	28 (49.1%)	19 (33.3%)	10 (17.5%)	57 (100%)
Low Intake	18 (34.0%)	22 (41.5%)	13 (24.5)	53 (100%)
CKD	32 (68.1%)	4 (8.5%)	11 (23.4%)	47 (100%)
DM	19 (54.3%)	9 (25.7%)	7 (20.0%)	35 (100%)
CVDNH	8 (40.0%)	3 (15.0%)	9 (45.0%)	20 (100%)
Vomit	12 (63.2%)	2 (10.5%)	5 (26.3%)	19 (100.0%)
Total	**117 (50.6%)**	**59 (25.5%)**	**55 (23.8%)**	**231 (100%)**

Table 13 Results of the Analysis Test *Chi-Square* Chloride and Chloride Levels Its Relationship to the Patient's Clinical Condition

Variable	X2	df	p-value
Comorbid X Chloride Status	12.626	5	0.027

Discussion of Characteristics of Elderly Patients by Gender

Based on the results of data processing in this study, the number of elderly patients with electrolyte disorders is dominated by women. Female elderly are recorded around 8% more than male elderly. These findings are in line with the literature written by Fujisawa et al. that older women tend to have more vulnerable physical conditions, one of which is due to a decrease in muscle mass and faster changes in body composition than men. (Fujisawa et al., 2022) . The study also stated that women are consistently more in the category of *frailty* (fragility) which is increasing. *Frailty* is associated with decreased kidney function, reduced body capacity to maintain fluid balance, and increased sensitivity to metabolic stress, thereby increasing the risk of dynatremia and dyskalemia. In addition, *postmenopausal women* experience a sharp decrease in the hormone estrogen which plays a role in the regulation of the Renin-Angiotensin-Aldosterone (RAAS) system and sensitivity to vasopressin. Decreased estrogen causes impaired urine concentration ability, increased susceptibility to hyponatremia, and is easier to change the volume of body fluids.

In addition, the findings also show a consistent pattern in Emergency Departments that women are twice as likely to develop hypokalemia as men, regardless of their disease status. From the clinical side, elderly women also use medications related to chronic diseases such as antihypertensives, diuretics, and osteoporosis therapy (calcium or vitamin D). (Pani et al., 2021)

Discussion of the Distribution of Clinical Conditions in Elderly Patients

The clinical conditions in elderly patients in this study showed quite a diverse pattern. The most common conditions that appear are infections with early diagnosis of pneumonia, infections of the genital tract and others. In addition to infections, nutritional problems in the form of low intake are also quite common. This condition can affect fluid and electrolyte balance, especially in patients who come in with a weak state or decreased intake (and will not eat) a few days before.

Chronic kidney disease and diabetes mellitus are also comorbidities that are quite often the reason for elderly patients to come to the emergency room. In addition, there are also other groups of diagnoses such as cerebrovascular disorders, gastrointestinal complaints such as vomiting, as well as some cardiovascular diseases. This variation of diagnosis illustrates that elderly patients generally come to the emergency room with clinical conditions that often involve more than one health problem.

Aslan et al. said in their study that infections such as pneumonia and urinary tract infections are one of the leading causes of emergency department visits in geriatric groups and play a major role in the increase in mortality. In the elderly, infections often cause non-typical complaints, such as behavioral changes or the appearance of delirium. (Aslan et al., 2023)

This finding is also strengthened by another study written by Uzun et al. which states that a history of hypertension is one of the most common comorbidities accompanying elderly patients, especially due to physiological changes due to the aging process that affect the

cardiovascular system and kidney function. In old age, there will be a decrease in the elasticity of blood vessels, an increase in peripheral resistance, and changes in hormonal regulation that make blood pressure more easily increased and difficult to control. This condition will then have an impact on the kidneys' ability to maintain electrolyte balance, so that the elderly with hypertension are more susceptible to sodium and potassium disorders, both due to disease progression and the use of certain antihypertensive drugs (Uzun Arda et al., 2025).

Osmotic diuresis that occurs in cases of chronic hyperglycemia in diabetes mellitus can trigger a loss of sodium and potassium in the blood, making patients more susceptible to hyponatremia and potassium disorders. Data in *Bezmialem Science* shows that DM is found in 70.7% of patients with hypomagnesemia, 61.3% of patients with hyperkalemia. These findings reinforce that microvascular kidney dysfunction, hyperglycemia, as well as the use of certain antidiabetic drugs can alter the filtration and reabsorption mechanisms of electrolytes. This condition is even more significant in the elderly group because the physiological reserve of the kidneys has decreased, so that electrolyte disorders become easier to appear and more difficult to correct (Heybeli et al., 2022).

In chronic kidney disease (CKD), progressive impaired kidney function can have a direct effect on the body's ability to maintain electrolyte balance. If there is a decrease in nephron function, the filtration, reabsorption, and excretion processes will no longer run optimally so that patients will more easily experience various disorders, such as hyponatremia due to fluid retention, hyperkalemia, a tendency to metabolic acidosis, to intravascular volume instability. This condition will become more complex in the elderly because the physiological reserve is generally lower. This is in line with the findings that hypertension, diabetes, and CKD often appear together in the elderly group with higher levels of *frailty*, and this group shows a greater risk of electrolyte impairment (Fujisawa et al., 2022).

Discussion of Sodium (Na^+) Disorders in Elderly Patients

In the sodium level examination, most of the elderly patients in this study were in the category of hyponatremia. These findings are quite in line with the clinical conditions often encountered in the elderly in the emergency room, where many factors can affect sodium balance, such as infections, decreased intake, vomiting, as well as chronic diseases such as diabetes and kidney disorders. In the infection and low intake groups, hyponatremia appears to be dominant, which may be related to impaired fluid regulation, increased sodium loss, or the presence of increased antidiuretic hormones during acute stress conditions. Hyponatremia is also seen quite frequently in patients with diabetes mellitus and vomiting complaints, where both of these conditions can lead to fluid and electrolyte imbalances. In patients with chronic kidney disease, the pattern of sodium disruption is more varied, with some patients experiencing hyponatremia and others hypernatremia, depending on the degree of kidney damage and the body's ability to maintain fluid balance.

Hyponatremia as the most commonly found electrolyte disorder was also mentioned by Fratangelo et al. in their research, especially in elderly patients who had previous comorbidities such as heart failure, chronic kidney failure, endocrine disorders, as well as patients who consumed certain medications. It is also explained by Netzer et al. that hyponatremia in elderly patients can cause clinical problems that require special attention. A decrease in sodium levels can cause a disturbance of osmotic balance at the cellular level, especially in nerve tissue, thereby triggering changes in mental status in the form of decreased attention, delirium, and

impaired executive function. Slightly disturbed sodium levels can also provide a meaningful clinical picture, the risk increases as the sodium levels get lower, and often reflects the presence of progressive underlying conditions such as impaired kidney function, heart insufficiency, or a high comorbid burden. (Fratangelo et al., 2023) (Netzer et al., 2025)

Discussion of Potassium Level Disorders (K^+), in Elderly Patients

H In the examination of potassium levels, most of the elderly patients in this study were in the normal range. However, patients with hypokalemia and hyperkalemia are still found. These disorders appear to vary according to the clinical condition of each patient. In the infection group, the majority were in the normokalemia category, as well as in patients with low intake and diabetes mellitus.

Hypokalemia is more common in patients with decreased intake and in those with chronic kidney disease. Both conditions can lead to potassium loss or disruption in maintaining electrolyte balance. Meanwhile, hyperkalemia is most commonly found in patients with chronic kidney disease, who do have limitations in excreting potassium.

In the study written by Qaisar et al., hypokalemia is referred to as a clinical finding that often appears and has a clear pathophysiological basis. In the elderly population, age-related physiological changes lead to reduced nephron function, decreased Na^+/K^+-ATPase pump activity, and decreased ability of the kidneys to maintain electrolyte balance, resulting in a greater risk of potassium loss through urine. Various comorbidities common in the elderly—such as hypertension, diabetes mellitus, and cardiovascular disease—often require the use of diuretic medications, which further increases susceptibility to hypokalemia (Qaisar et al., 2025) .

In addition, Claude Alain et al. describe that the elderly with comorbidities such as diabetes have an additional risk of potassium disruption due to changes in kidney regulation and impaired tubular function. Hypokalemia conditions in this group can have significant clinical impacts, ranging from myocardial repolarization disorders, increased risk of ventricular arrhythmias, muscle weakness and cramps, to tissue perfusion disorders. The combination of hypokalemia and hypomagnesemia that often occurs in diuretic patients increases the risk of neuromuscular instability as well as the incidence of falls in the elderly. Overall, the findings suggest that hypokalemia is an important marker of electrolyte homeostasis disorders that can worsen the clinical condition of the elderly, especially the elderly who have cardiovascular or metabolic comorbidities. (Claude Alain et al., 2025)

Discussion of Chloride (Cl^-) Level Disorders in Elderly Patients

Based on the results of chloride examination in elderly patients showed that most were still within the normal range. However, a number of patients still experience disturbances in chloride levels, both in the form of decreased and increased. This variation is related to different clinical conditions in each patient. Hypochloremia is more commonly found in patients with poor nutritional intake and in patients with chronic kidney disease. Both conditions can disrupt the balance of fluids and electrolytes, making it easier for chloride levels to decrease. On the other hand, increased chloride levels are more common in patients with chronic kidney disease, who do have limitations in regulating electrolyte concentrations.

These findings are in line with the research of Chen et al. Which reports that hypochloremia in patients with chronic diseases generally arises through two main physiopathologists. The first mechanism is *dilutional hypochloremia*, which occurs due to the

retention of free fluids so that the concentration of chloride in the plasma decreases. The second mechanism is *depletional hypochloremia*, which is the loss of chloride through the gastrointestinal tract or kidneys, especially in patients taking *loop diuretics*. Both of these processes contribute to the activation of the neurohormonal system, resistance to diuretic therapy, impaired metabolic stability, as well as an increased risk of clinical deterioration. The study emphasizes that changes in chloride levels reflect fluid homeostasis instability and can be an important indicator of the deterioration of the physiological condition of the elderly, especially those with chronic inflammation, impaired kidney function, or cardiovascular disease. (Chen et al., 2025)

The explanation is consistent with the case report by Mizutani et al. which said that elderly patients with multiple comorbidities and *polypharmacy* exposure have a high susceptibility to chloride disorders. In this group, hypochloremia generally arises due to a combination of loss of chloride through the kidneys, age-related changes in tubule function, and chloride-resistant metabolic alkalosis, especially in diuretic users and agents that affect the renin–angiotensin–aldosterone system. This disorder causes an imbalance in the regulation of volume and acid-bases, so that the body is unable to maintain optimal physiological compensation. (Mizutani et al., 2023) .

Health of the Elderly in the Perspective of the Quran and Hadith

The aging process in old age involves various factors that must be considered and handled so that the elderly can still maintain independence in maintaining their health. This aging process certainly has an impact on various aspects of life, including social and economic, but the most crucial aspect is health. As we age, the function of the body's organs will decrease which can affect the quality of life. (Yetri, 2025) As stated in the letter QS. Yāsīn [36]: 68

Meaning: *"And whoever We prolong his life, We will return him to the beginning of (his) event. Then why don't they understand?"*

The above verse explains the nature of the human life cycle which describes the power

وَمَنْ نُّعَمِّرْهُ نُنَكِّسْهُ فِي الْخَلْقِ ۗ اَفَلَا يَعْقِلُوْنَ ۝٦٨

of Allah SWT in creating, maintaining, and returning humans to their original condition. In this verse it is emphasized that when a person is given a long life, he will gradually decline both physically and mentally, until he returns to a weak state like when he was a child. This phenomenon is a tangible manifestation of the mortal nature of worldly life and proof that everything in the world is subject to God's will and decree. Through the tafsir *of Tajahul Al'Arif***,** especially in the expression (*do they not understand*?), Allah SWT conveys a subtle form of insinuation that is full of meaning, namely an affirmation of the negligence of humans who actually know the truth about the mortality of life, but still ignore the signs of His greatness and power. In this context, the use of this style of language serves to arouse the intellectual and spiritual awareness of human beings so that they reflect on their life journey. This verse is not only theological, but also contains reflective and educational values that invite humans to realize their limitations, make the best use of life, and multiply charitable deeds as provisions for the hereafter. Thus, this verse becomes a profound reminder of the uncertainties of age and

the importance of existential awareness in living a life in harmony with the Divine will. (Ivlatia et al., 2025)

Based on the above verse, it can be understood that the condition of human weakness in old age is a certainty that is directly mentioned by Allah SWT. as part of the life cycle. Clinically, the aging process is characterized by a decrease in physiological reserves in almost all organ systems. This is seen in the reduced compensatory ability of the cardiovascular system, decreased conduction and nerve response, decreased skeletal muscle strength and mass, and impaired cognitive function that can affect the body's response. In addition, From a medical point of view, the stability of the body's homeostasis, especially electrolyte balance, needs to be well maintained, considering that its disorder can aggravate physical weakness and contribute to the decline of cognitive and psychological function in the elderly. However, this perspective does not solely describe biological reality, but also provides a reflective basis for humans to maintain health as part of the responsibility to the body bestowed by Allah SWT.

This is also emphasized in another verse in the Qur'an, namely Surah An-Nahl verse 70, which explains the decline in bodily function in humans whose life span is extended by Allah SWT as part of His decree on the life cycle.

It means: *"Allah created you, then died; and some of you have been restored to the weakest*

وَاللَّهُ خَلَقَكُمْ ثُمَّ يَتَوَفَّىٰكُمْ ۚ وَمِنكُم مَّن يُرَدُّ إِلَىٰ أَرْذَلِ الْعُمُرِ لِكَيْ
لَا يَعْلَمَ بَعْدَ عِلْمٍ شَيْئًا ۚ إِنَّ اللَّهَ عَلِيمٌ قَدِيرٌ ۝٧٠

age, so that he will no longer know anything that he once knew. Indeed, Allah is All-Knowing, All-Powerful." (An-Nahl [16]: 70)

According to Quraish Shihab's interpretation in Tafsir Al-Misbah, the verse illustrates that only Allah SWT has the power to create human beings from a state of non-existence to existence, through the process of meeting between sperm and ovum until finally being born into the world with the potential to grow and develop. After that, Allah also determines the death of every human being in a way and at different ages some die when they are children, teenagers, adults, and in old age. Some humans are endowed with birth and mental strength so that their physical and mental condition is maintained, while others are extended their life until they experience a gradual decline in bodily functions. In this phase, humans become weak and helpless, both physically and psychologically, due to weakening of muscles, decreased performance of body cells, and reduced memory until they finally become senile and lose the ability to know things that they previously understood. After going through these stages, humans will return to death. Allah SWT is All-Knowing of all the secrets of His creation and Almighty over all things (Mutaqin, 2018) .

This verse gives an idea that the aging process is part of the sunnatullah that must occur in every human being. It is explained that "*and among you there are those who are returned to the weakest age (senility)"* it indicates that the older a person gets, Allah SWT will revoke the blessings given during his life, and if the human being is not ready to face them, then he will undoubtedly experience difficulties, In the context of the health of the elderly, maintaining the

body's functions including maintaining electrolyte balance, nutritional intake, and a healthy lifestyle is a form of effort and gratitude for the life extended by Allah SWT. Thus, maintaining health is not only a medical demand, but also a form of worship and the practice of Islamic values in appreciating Allah's creation.

In one of the hadiths narrated by Abu Hurairah, the Prophet صلى الله عليه وسلم said:

حَدَّثَنَا خَلَفٌ قَالَ حَدَّثَنَا أَبُو مَعْشَرٍ عَنْ سَعِيدٍ عَنْ أَبِي هُرَيْرَةَ قَالَ
قَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ مَنْ عَمَّرَ سِتِّينَ سَنَةً أَوْ سَبْعِينَ سَنَةً فَقَدْ عُذِرَ إِلَيْهِ فِي الْعُمُرِ

Meaning: *"Having narrated to us Khalaf said, narrated to us Abu Ma'syar from Sa'id from Abu Hurairah, he said, the Messenger of Allah PBUH said, "Whoever lives up to sixty or seventy years, then he has matured in life."* (HR. Ahmad, No. 8883).

According to the Islamic perspective, old age is not just a period of physical deterioration, but a stage of deepening of mental quality including increasing repentance, dhikr, self-reflection, and social contribution. This meaning is in accordance with the message of the hadith which states that a person who has reached that age (Bensaid, B., & Grine, 2014) *"no longer has a reason to continue to be negligent",* because Allah has given him a long life, maturity of reason, and repeatedly the opportunity to return to Him. The expression *fa-qad 'udzira ilaih* is not intended as an abolition of obligation, but as an affirmation of the upholding of reason before Allah. Ibn Rajab al-Hanbali in *Jāmi' al-'Ulūm wa al-Hikam* explains that the breadth of age clarifies one's moral responsibility; if he remains ignorant, it is his own choice (Al-Hanbali, n.d.)

The above hadith shows that Allah SWT. gives humans a long life not without purpose. Even though as we age, the human body will experience a decrease in function and weakness in some limbs, but Allah swt. It also provides an opportunity for humans to take advantage of their very long time to improve themselves. For example, when a person in his youth does not take advantage of the time to truly worship Allah SWT, then a long life is an opportunity for humans to improve themselves by increasing their worship, sanctifying their worship, and improving their deeds.

Electrolyte Balance in the Perspective of Maqasshid Shariah: An Islamic View of the Islamic View on Elderly Health Care

The results of this study show that electrolyte imbalance, especially sodium, potassium, and chloride, is a condition that is commonly found in elderly patients who come to the Yarsi Hospital Emergency Room. This pattern shows that the elderly are in a phase of physiological vulnerability due to changes in body structure, decreased kidney capacity, polypharmaceuticals, and the presence of comorbidities that increase the risk of hyponatremia, hypokalemia, and hypochloremia. This imbalance causes weakness of the limbs, decreased consciousness, and impaired bodily functions that can hinder daily activities and worship.

From an Islamic perspective, maintaining the health of the elderly is part of the ability to maintain the quality of worship and welfare of life. According to Islam, old age is not merely a period of biological decline, but a stage that demands physical maintenance, emotional calm, and continuity of worship activities. When electrolyte disturbances inhibit mobility,

concentration, and awareness, the quality of worship and social interaction of the elderly is also affected. Therefore, maintaining electrolyte stability is not only of medical value, but also has spiritual significance for the continuity of worship in the elderly. (Mat Salleh et al., 2022)

From the perspective *of maqasid sharia*, the maintenance of the health of the elderly is closely related to the main goals of sharia, namely maintaining the soul (*hifz al-nafs),* maintaining the intellect (*hifz al-'aql*), maintaining offspring (*hifz al-nasl*), and maintaining the quality of life through the maintenance of the body as a whole. Explains that (Rus Yandi, Basrial Zuhri, Kaksim, Ahmad Sibawai, 2024) *HEFZ al-NAFS* is the basis for the obligation to maintain health, including preventing conditions that can endanger survival such as dehydration, fluid imbalance, or electrolyte disorders. Efforts to maintain the health of the elderly are also part of *hifz al-'aql*, considering that electrolyte disorders such as hyponatremia can affect cognitive function and consciousness.

The same emphasis is conveyed by those who show that the care of the elderly within the framework of maqasid sharia requires the protection of biological and psychosocial aspects at the same time. In this context, electrolyte monitoring is part of efforts to maintain the dignity and quality of life of the elderly, since imbalances in sodium, potassium, and chloride are strongly related to physical weakness, the risk of falls, delirium, and increased hospitalization rates. (Mat Salleh et al., 2022)

In addition, the principle *of dar' al-mafasid* (preventing harm) as explained by affirming that all actions aimed at preventing disease and strengthening the condition of the body are included in the maintenance of maslahat. Electrolyte control in the elderly is in line with this principle, as medical measures such as adequate hydration, laboratory monitoring, and control of comorbidities are real efforts to prevent further damage or harm. (Ahmad et al., 2017)

Overall, electrolyte balance in the elderly is not only a clinical issue, but also part of fulfilling moral and religious responsibilities in maintaining life safety. Thus, medical intervention against electrolyte disorders is in line with the sharia maqasid, as it supports the protection of health and the sustainability of body functions in the elderly group.

CONCLUSION

This study on electrolyte disorders (sodium [Na^+], potassium [K^+], and chloride [Cl^-]) in elderly emergency room patients at Yarsi Hospital (January–December 2023) found significant associations (chi-square $p<0.05$) between clinical conditions like infection, low food intake, chronic kidney disease, diabetes mellitus, vomiting, and these imbalances, with hyponatremia being the most prevalent—especially among older women (8% higher incidence than men)—highlighting sodium's vulnerability in this group and the role of comorbidities in disrupting balance. From the *Hifẓ an-Nafs* perspective, maintaining electrolytes through monitoring, comorbidity management, nutrition, and complication prevention aligns with protecting the soul in vulnerable elderly populations. For future research, a prospective longitudinal study could track interventions' effectiveness in preventing recurrent disorders and explore sex-specific risk factors or nutritional strategies in diverse elderly cohorts.

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