



Profile of Potassium Serum in Coronary Heart Disease (CHD)

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Abstract. Potassium level is closely related to the prognosis in several phases of a disease, especially in cardiovascular disease. Severe hypokalemia causes arrhythmia leading to cardiac arrest. Therefore, it is necessary to monitor potassium levels in patients with cardiovascular disease. This study aims to assess the potassium profile in coronary heart disease patients who were hospitalized and outpatients. This research is a descriptive study. The data was collected from medical records of various cases of cardiovascular disease. The patients were taken from cardiac polyclinics and those hospitalized for cardiovascular disease, a total of 105 patients with a diagnosis of all cardiovascular diseases. Potassium levels were divided into three groups: hypokalemia with a potassium level of < 3.6 mEq/L, normal with a potassium level of $3.6 - 5.5$ mEq/L, and hyperkalemia with a potassium level of > 5.5 mEq/L. Each classification of potassium level is then associated with the age and the diagnosis of the patient. The results of this study are 6.67% has potassium of < 3.6 mEq /L, 5.71% has potassium of > 5.5 mEq / L, and 87.62% has potassium of $3.6 - 5.5$ mEq/L. Hypokalemia occurs predominantly in the arrhythmia diagnosis, NSTEMI (Non-ST-Elevation Myocard Infarct), and ventricular hypertrophy (28.57%). Hypokalemia is mostly recorded in those aged 56–60 years (42.85%). Hypokalemia is least recorded in those who were 56 years with a diagnosis of arrhythmia VES. Hyperkalemia is predominant in the diagnosis of arrhythmia (50%). Hyperkalemia varies according to the age groups. Cardiovascular diseases which have a risk of hypokalemia are arrhythmia, NSTEMI, and ventricular hypertrophy. The risk of hypokalemia and hyperkalemia increases at the arrhythmia diagnosis..

Keywords: Hyperkalemia · Hypokalemia · Heart Disease

1 Introduction

Non-communicable diseases still cause the cause of high mortality in the world. Coronary heart disease is a non-communicable disease in which the heart and blood vessels do not function normally. The World Health Organization (WHO) stated that in 2019 there were 17.9 million people annually die from cardiovascular disease and 32% was the cause of global death [1]. This mortality rate is predicted to increase and is estimated by WHO to reach 23.3 million deaths by 2030.

The previous study reported that coronary heart disease (CHD) is the number one killer in Indonesia [2]. Data from Basic Health Study 2018 stated that the prevalence of coronary heart disease was 1.5% based on a doctor's diagnosis. This result has increased from 2013 by 0.5% [3].

Coronary heart disease (CHD) is a heart disease caused by narrowing the coronary arteries due to plaque build-up or spasm in the heart arteries or both [4]. A previous study stated that one of the independent predictors of life-threatening events in CHD patients was hypokalemia (log-rank $P = 0.014$) [5] [6].

The incidence of hypokalemia in CHD from previous studies showing signs of progression made the study related to the potassium profile in coronary heart disease significant. It is vital because knowing potassium levels in CHD patients can provide an overview of preventive and curative efforts to reduce morbidity and mortality in CHD with hypokalemia.

2 Method

The design of this study was an analytical observational study which studies the distribution of potassium profiles in cardiovascular disease patients who were hospitalized or outpatient for the period July 2020 to July 2021.

The time of the study was carried out in August 2021. The data was collected from the Medical Record Installation. The samples were from all patients with cardiovascular disease who were recorded in the medical records of the patients who were hospitalized and outpatient department of Internal Medicine, with complete data in the form of potassium examination results. The samples used consecutive sampling techniques. The inclusion criteria used in this study were all medical record data of patients with cardiovascular disease who were hospitalized and outpatients which contained data on their blood potassium examination results. The exclusion criteria used in this study were incomplete medical record data.

The data analysis is to determine the distribution of potassium profile in patients with coronary heart disease using data presentation through study data tables.

3 Result and Discussion

This study was conducted in August 2021 with a total of 105 patients with a diagnosis of all cardiovascular diseases who were hospitalized and outpatient for the period July 2020 to July 2021 and had completed medical record data in the form of potassium examination results.

A total of 105 patients with cardiovascular disease were 52% of adult patients (18–59 years) more than the elderly (≥ 60 years) of 48%. More women (57%) have cardiovascular disease than men (43%). The results of potassium levels from 105 patients with cardiovascular disease at most had normal potassium levels of 87%. Hypokalemia (<3.6 mmol/L) comprised 7% and hyperkalemia (>5.5 mmol/L) comprised 6%.

Patients with hypokalemia were 56 years old on average, with a minimum age of 29 years and a maximum age of 74 years. Patients with normokalaemia were 54 years old with a minimum age of 17 years and a maximum age of 88 years. Patients with

Table 1. Characteristics of Subjects

No	Characteristics	Frequency	Percentage (%)
1	Age (year)		
	a. Adult (18–59)	55	52
	b. Elderly (≥ 60)	50	48
2	Sex		
	a. Men	45	43
	b. Women	60	57
3	Potassium Level (mEq/L)		
	a. Hypokalemia (< 3.6)	7	7
	b. Normokalemia (3.6–5.5)	92	87
	c. Hyperkalemia (>5.5)	6	6

Table 2. Profile of Potassium

	Minimum (year)	Maximum (year)	Mean (year)	Men (%)	Women (%)
Hypokalemia	29	74	56	14	85
Normokalemia	17	88	54	45	54
Hyperkalemia	54	84	69	31	67

Table 3. Diagnosis of Subjects

No	Diagnosis	Total	Percentage (%)
A	Hypokalemia		
1	Arrhythmia	2	29
2	Ventricular Hypertrophy	2	29
3	CHF	1	14
4	NSTEMI	2	28
B	Hyperkalemia		
1	Arrhythmia	3	50
2	Unstable Angina	1	17
3	Stable Angina	1	17
4	CHF	1	16

CHF = Congestive Heart Failure; NSTEMI = Non ST Elevasi Myocard Infarct

hyperkalemia were 69 years old on average, with a minimum age of 54 years and a maximum age of 84 years.

Patients with hypokalemia mainly were female 85%, compared to male, only 14%. Similarly, normokalemia (54%) and hyperkalemia (67%) were mostly women.

Patients with hypokalemia had a relatively even variety of diagnoses, specifically, arrhythmia, ventricular hypertrophy, and NSTEMI, each with 29%. The most minor diagnosis was Congestive Heart Failure consisting of 1 patient (14%) (Table 3).

Patients with hyperkalemia had the most diagnosis of arrhythmia (50%) then followed by unstable angina, stable angina, and CHF 16%.

4 Discussion

This study aims to describe the profile of potassium in coronary heart disease in hospitalized and outpatients. Knowing the potassium profile in patients with coronary heart disease can help provide an overview for preventive and curative efforts to reduce morbidity and mortality in CHD with potassium disorders.

The 105 patients with cardiovascular disease (Table 2) showed that the average age of patients with hypokalemia was 56 years (43%) and the average age of patients with hyperkalemia was 69 years.

These results show that the average patient with cardiovascular disease accompanied by potassium disorders is in the elderly group (≥ 60 years). The analysis results using an independent T-test between age and potassium in patients obtained $p = 0.040$. Which means that there is a significant relationship between age and the patient's potassium level. It is following the literature that as the older the greater the risk of coronary heart disease [9] [10].

The results of this study also showed that women had a greater percentage of 57% compared to men in all patients with cardiovascular disease (Table 1), and in patients with hypokalemia 85% (Table 2) and hyperkalemia 67% (Table 2). This result is by the theory that as women age, menopausal women experience a significant reduction in the hormone estrogen, which can result in the protective function of estrogen for the body being reduced as well, so the risk of coronary heart disease will also increase [7] [8].

In these 105 patients, the most significant percentage with normal potassium levels was 88%. Meanwhile, hypokalemia (< 3.6 mEq/L) and hyperkalemia (> 5.5 mEq/L) were only 6.67% and 5.71%, respectively. These results indicate that patients with cardiovascular disease do not experience hypokalemia or hyperkalemia. It is in line with a study by Walsh (2002) explaining that from 3151 study subjects, serum potassium levels are not associated with cardiovascular disease [17].

However, abnormal potassium levels can cause several disorders in the body. Severe hypokalemia causes arrhythmia to the point of cardiac arrest. In addition, mild to moderate hypokalemia can be associated with a poor prognosis in patients with several diseases such as cardiovascular or chronic renal failure [14][15]. Meanwhile, hyperkalemia can cause cardiac arrhythmia, and at higher concentrations, it can cause cardiac arrest [11] [13]. Connie (2013) also stated that increasing potassium consumption in patients with hypertension and having a habit of consuming high sodium can lower blood pressure [16].

Austin's study (2017) showed that high serum potassium concentrations 5.0 mEq/L were associated with all-cause mortality, one of which was death from cardiovascular disease, especially among diuretic users [12] [18].

The most common diagnoses for cardiovascular disease with hyperkalemia are arrhythmia, followed by unstable angina, stable angina, and CHF. Meanwhile, the most common diagnoses in hypokalemia were arrhythmia, ventricular hypertrophy, NSTEMI, and CHF. It is in accordance with the theory that abnormal potassium levels, both hypokalemia and hyperkalemia, can cause disturbances in heart rhythm so that more arrhythmias will occur [14][13].

The limitations of this study are that the number of study subjects used is small, only using one-year periods of outpatients and hospitalized patients. Then the following limitation is the analysis of the data used in this study only descriptively and using an independent t-test in the potassium category with the patient's age. Our recommendation for further study is to add more comprehensive study subjects and use more complex study methods and data analysis methods.

5 Conclusion

There were 7% has potassium of < 3.6 mEq/L, 6% has potassium of > 5.5 mEq/L, and 87% has a potassium of $3.6 - 5.5$ mEq/L. Hypokalemia occurs predominantly in the diagnosis of arrhythmia, NSTEMI, and ventricular hypertrophy (29%). Hypokalemia is mostly recorded in those were aged 56–60 years (43%). Hypokalemia is least recorded in those were aged 56 years with a diagnosis of arrhythmia. Hyperkalemia is predominant in the diagnosis of arrhythmia (50%). Hyperkalemia varies according to age group.

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