

# The Incidence of Hypokalemia in Medical Patients

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## ABSTRACT

*Background: Hypokalemia is one of the most common electrolyte disorders in hospitalized patients. If hypokalemia were found, the underlying cause should be identified and treated. The incidence study of hypokalemia in Indonesia hospitalized patients is rarely reported.*

*Objective: To investigate the incidence of hypokalemia in medical patients at the medical wards of department of internal medicine Gatot Soebroto Army Hospital.*

*Method: Patients who required administration of parenteral fluid for various indications, irrespective of diagnosis, length of stay and types of infusion or medications were included in this study. Serum sodium and potassium concentration were checked twice, first at their admission and the second at discharge. The study form contained data record of patient's initials, age, gender, dates of admission and discharge, medical record number, laboratory findings of serum sodium and potassium concentration at admission and discharge.*

*Result: 103 subjects were enrolled with mean age 49 years old (ratio of female: male = 70:30). Serum sodium concentration at admission and discharged were not significantly different. Incidence of hypokalemia was 26%. Furthermore, serum potassium concentration at admission and discharge showed significant reduction from mean concentration of 4.06 mmol/L to 3.83 mmol/L (with  $P=0.02$ ). The number of patients with hypokalemia increased significantly during hospitalization (from 27 to 45 patients, with  $p=0.023$ ). Additional data showed that the types of infusion solutions given to patients are as follows: ringer's lactate (52 patients), normal saline (22 patients), D5W (20 patients) and asering/ringer's acetate (9 patients).*

*Conclusion: The incidence of hypokalemia in medical patients at the medical wards of department of internal medicine Gatot Soebroto Army Hospital was 26%. These patients did not have sodium abnormalities. Number of patients with hypokalemia increased during hospitalization. Most infusion solutions administered contain very low concentration of potassium (ringer's lactate and ringer's acetate 4 mmol/L) or no potassium at all (normal saline, D5W).*

**Keywords:** *Hypokalemia, hospitalized patients, serum potassium concentration*

## INTRODUCTION

Hypokalemia (serum  $K^+ < 3.5$  mmol/L) is one of the most common electrolyte disorders in hospitalized patients.<sup>1</sup> In the United States, up to 20% of hospitalized patients have hypokalemia,<sup>2</sup> but clinically significant hypokalemia accounts for only 4% to 5% of these patients. The incidence in hospitalized patients receiving diuretics is 40%.<sup>3,4</sup> While serum potassium

concentration accounts for only 2% of total body potassium and in many cases it does not represent the status of body potassium. This fact should be well understood because all medical intervention for treating hypokalemia is based on serum potassium concentration.<sup>5</sup>

Hypokalemia is generally tolerated in otherwise healthy individuals, particularly those with mild and

asymptomatic condition. However, it can be life-threatening when the serum potassium is very low, especially in cardiac patients.<sup>6,7</sup> Therefore, precaution is highly needed in view of the fact that hypokalemia during hospitalization is not managed adequately.<sup>8</sup>

Medical wards are selected in this study because previous study had indicated that hospital malnutrition in medical patients was about 40%, and higher in patients with longer hospital stay.<sup>9</sup> This situation may lead to the possibility of high incidence of hypokalemia as well.

### OBJECTIVE

The main objective of this epidemiological study is to investigate the incidence of hypokalemia in medical patients treated at the medical wards of Department of Internal Medicine, Gatot Subroto Army Hospital and to observe the tendency of serum potassium concentration during hospitalization.

### MATERIALS AND METHOD

#### Patients

Study samples were patients hospitalized at the medical wards of Department of Internal Medicine, Gatot Subroto Army Hospital, who required administration of parenteral fluid for various indications,

irrespective of diagnosis, length of stay and types of infusion solutions (including amount and length of infusion) or medication.

### Methods

Patients who fulfilled the study criterias had their serum sodium and potassium checked, twice by the laboratory of Clinical Pathology. The first examination was taken at patient admission and the second examination was at discharge or several days after parenteral fluids had been discontinued or other causes (e.g. premature patient discharge or death). Then, the investigator will fill in study form to record patient's initials, age, sex, dates of admission and discharge, medical record number, laboratory findings of serum sodium and potassium concentration at admission and discharge. Statistic analysis was performed using t-test for numerical data and chi-square for parameters.

### RESULTS

#### Patients Demography

103 patients were enrolled during the period of January to August 2004. Mean age was 49 years old and the ratio of male to female patients was 70:30.

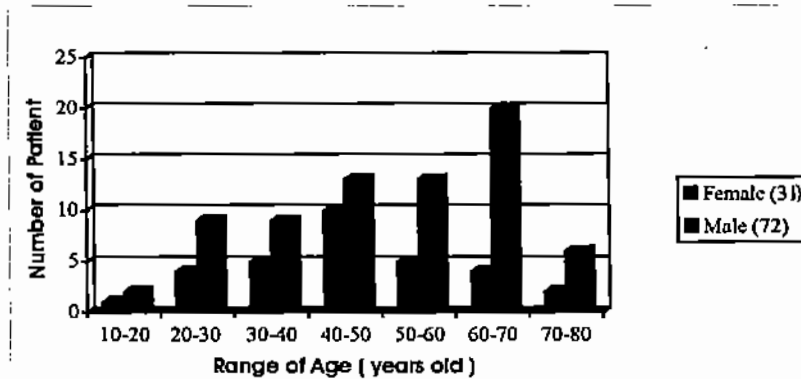


Figure 1. Distribution of patients according to Gender and Age (n = 103)

**Table 1. Diagnosis of Patients**

<b>Diagnosis</b>	<b>Number of Patients</b>
Diabetes mellitus type 2 with ulcer	27
Dengue hemorrhage fever	11
Gastroenteritis of enteritis	9
Chronic renal failure for hemodialysis	8
Cirrhosis hepatic	7
Post stroke e.c. hypertension	6
Febrile observation e.c. typhoid	4
Lung tuberculosis	4
Febrile observation e.c. malaria	4
Renal insufficiency	3
Asthma bronchial	3
Decompensation cordis	3
Gastritis chronic + hematemesis	3
Febrile observation e.c. hepatitis	2
Colitis ulcerative	2
Pneumonia	1
Myocardial infarction	1
Hernia nucleosus pulposus	1
Gastropathy	1
Coronary arterial disease + anemia	1
Dyspepsia	1
Ca of sinus	1
<b>Total</b>	<b>103</b>

**Table 2. Mean Serum Sodium Concentration during Admission and at Discharge**

<b>Treatment</b>	<b>Serum Sodium (mmol/L)</b>	<b>P</b>
Admission	138.49 ± 7.17	0.468
Discharge	138.98 ± 5.50	

**Table 3. Comparison of Serum Sodium at Various Categories**

<b>Treatment</b>	<b>Number of Patient</b>			<b>P</b>
	<b>Hyponatremia</b>	<b>Normonatremia</b>	<b>Hypernatremia</b>	
Admission	21	71	11	0.792
Discharge	19	70	14	

Note: hyponatremia < 135 mmol/L., normonatremia = 135-145 mmol/L., hypernatremia > 145 mmol/L.

**Examination of Serum Sodium Concentration**

There was no significant difference between serum sodium concentration at admission and discharge

**Examination of Serum Potassium**

The incidence of hypokalemia in medical patients at the medical wards of department of internal medicine Gatot Soebroto Army Hospital is 26% (27 hypokalemic patients from total of 103 enrolled patients).

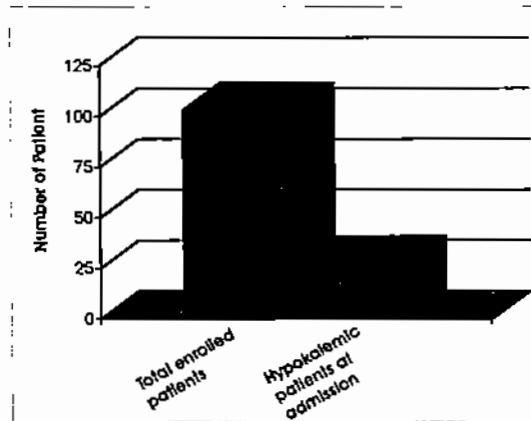


Figure 2. Comparison between Total Enrolled Patients and Hypokalemic Patients at Admission (n=103)

**Table 4. Mean of Serum Potassium Concentration During Admission and at Discharge**

Treatment	Serum Potassium (mmol/L)	P
Admission	4.06 ± 0.87	0.02
Discharge	3.82 ± 0.69	

**Table 5. Comparison of Serum Potassium at Various Categories (n =103)**

Treatment	Number of Patient			P
	Hypokalemia	Normokalemia	Hyperkalemia	
Admission	27	64	12	0.03
Discharge	45	50	8	

There was a significant decrease in mean serum potassium concentration during hospitalization.

In group of patients with hypokalemia at admission, there was a significant increase of patient number from 27 (26.2%) to 45 patients (43.7%).

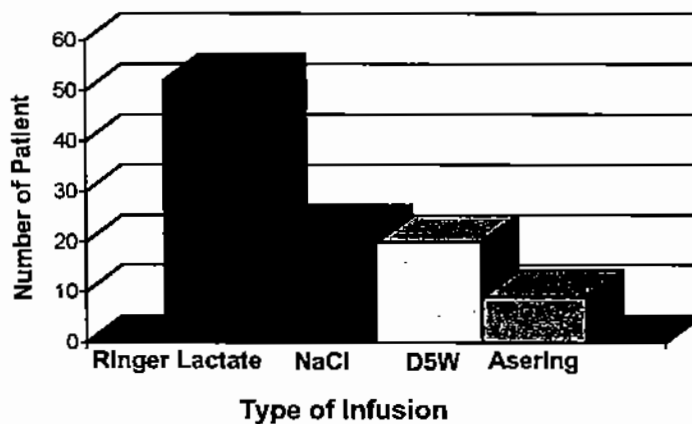


Figure 3. Type of Infusion Administered to Patients (n=103)

Table 6. Electrolyte Composition of Each Infusion Solution

Product Name	Electrolytes						Dextrose (g/L)	Calories (kcal)	Osmm. Pressure (mOsm/L)	Volume (ml)	Package
	Na <sup>+</sup>	K <sup>+</sup>	Ca <sup>++</sup>	Cl <sup>-</sup>	Lactate	Acetate					
Otsu D5							50	200	278	500	Plabottle
Otsu RL	130	4	3	109	28				273	500	Plabottle
Otsu NS	154			154					308	500	Plabottle
Asering	130	4	3	109		28			273	500	Plabottle

#### ADDITIONAL DATA

Number of patients and types of infusion which was administered were as follows, ringer's lactate was 52 patients, normal saline was 22 patients, D5W was 20 patients, and ringer's acetate was 9 patients. Electrolyte composition of each infusion solution is shown in figure 3 and table 6.

#### DISCUSSION

Most patients enrolled in this study were from age group 60-70 years old with female to male patient ratio was 7:3. This may correlate with decreased body resistance and increased susceptibility to illness in elderly patients (see figure 1).

At the early phase of fluid and electrolyte deprivation, the body will retain sodium as priority compared to potassium. This is in line with the body homeostasis, by mechanism of sodium retention at distal tubules.<sup>1</sup> With regard to serum sodium concentration in this study, there were no significant changes at admission and discharge or when compared in various categories (hyponatremia, normonatremia and hypernatremia; see table 2 and 3).

There was a significant decrease in serum potassium concentration during hospitalization ( $4.06 \pm 0.87$  at admission;  $3.824 \pm 0.69$  at discharge;  $P = 0.02$  or  $P < 0.05$ ; see table 4). In group of patients with hypokalemia at admission, there was a significant increase of patient number from 27 to 45 patients. This

means that 8 patients became hyperkalemic during hospitalization ( $P = 0.03$  or  $p < 0.05$ ; see table 5). Hypokalemia is rarely detected based on clinical condition, because it is often asymptomatic, particularly in mild hypokalemia (serum  $K^+$  3.0- 3.5 mmol/L).

Hypokalemia is diagnosed by measurement of serum potassium concentration. Symptoms of mild hypokalemia are nonspecific, such as fatigue, general weakness and constipation. Muscle necrosis and ECG abnormalities are obvious when the serum potassium falls below 2.5 mmol/L. Ascending paralysis and respiratory muscle paralysis as well as life threatening arrhythmia occur when serum potassium is below 2 mmol/L. In patients without underlying cardiac pathology, disturbance of cardiac conduction is very rare despite the serum potassium concentration less than 3 mmol/L. However, in patients with myocardial ischemia, heart failure, left ventricular hypertrophy, mild to moderate hypokalemia may trigger arrhythmia.<sup>1,5</sup> In this study, no patient was found to have heart disease because the patients with heart disease hospitalized in separate ward.

The incidence of hypokalemia in this study was 26% (figure 3). This figure is still higher than the incidence reported in the US which was reported 20% (Zwanger et al).<sup>2</sup> The number of patients with hypokalemia increased when infusion solution had been discontinued. Apparently more normokalemic patients had become hypokalemic during hospitalization (from 64 to 50, see table 5). It remains to be determined if hypokalemia is undertreated in hospitalized patients as reported from a study in US.<sup>8</sup>

## CONCLUSION

A incidence study on blood electrolyte pattern has been conducted in 103 medical patients treated at Department of Internal Medicine, Gatot Subroto Army Hospital, regardless the diagnosis, length of stay, and medication. The incidence of hypokalemia (serum potassium concentration  $< 3.5$  mmol/L) was 26%. These patients did not have sodium abnormalities. Number of patients with hypokalemia increased during hospitalization. Most infusion solutions administered contain very low concentration of potassium (ringer's lactate and ringer's acetate 4 mmol/L) or no potassium at all (normal saline, D5W).

In the near future maintenance type infusion solution should be encouraged to medical patients who are not able to take adequate amount of fluid and electrolyte in order to prevent hypokalemia. Ideally, infusion solution

(KAEN 3B) containing sodium and potassium in sufficient amount to fulfill daily requirement should be used instead of fluid replacement solely.

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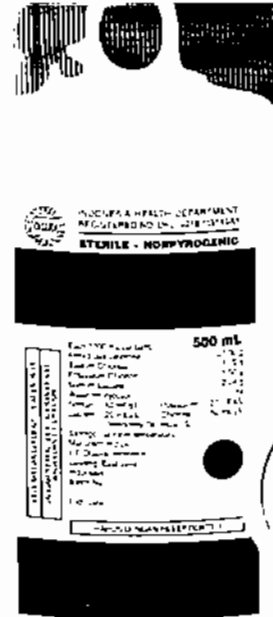
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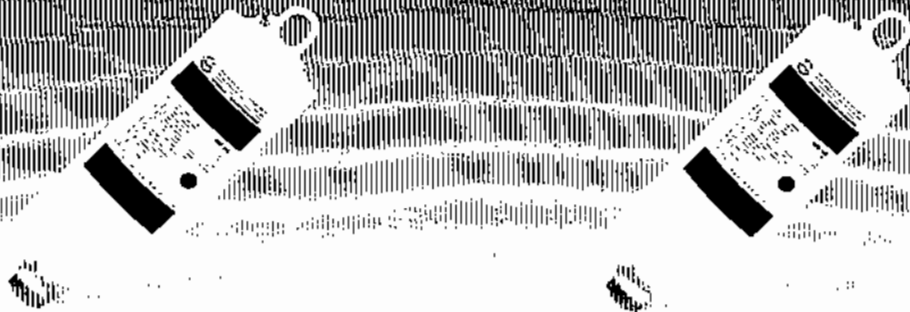


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