

# The Prevalence of Hypokalemia in Hospitalized Patients with Infectious Diseases Problem at Cipto Mangunkusumo Hospital, Jakarta

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## ABSTRACT

**Aim:** to know the prevalence of hypokalemia that occurs in hospitalized patients with infectious diseases.

**Methods:** a cross sectional study was carried out in the internal ward Cipto Mangunkusumo General Hospital in Jakarta from December 2005 until June 2006. All hospitalized patients with infectious diseases receiving "replacement solution" were included in this study. We collected the blood sample to perform the serum potassium level at the time of admission and discharge.

**Results:** one hundred and five patients were enrolled in this study; consisting of 44 males and 61 females. The age ranged from 14 to 70 years old. The most common infectious diseases were dengue fever, while the underlying diseases were hepatobiliary disorders. "Replacement solutions" which were given, were ringer's lactate 91%, normal saline 8%, and ringer's acetate 1%. Prevalence of hypokalemia among the hospitalized patients, on admission was 24 patients (23%) and during hospitalization was 39 patients (37%). The mean level of hypokalemia on admission was  $3.11 \pm SD 0.37$  mEq/L (range from 1.7 to 3.4 mEq/L) and during hospitalization was  $3.13 \pm SD 0.25$  mEq/L (range from 2.5 to 3.4 mEq/L). On admission, the ratio of mild : moderate : severe hypokalemia is 22 : 2 : 1. And at discharge the ratio of mild to moderate hypokalemia becomes 19 : 6.

**Conclusion:** the prevalence of hypokalemia in hospitalized patients with infectious disease in Cipto Mangunkusumo's Hospital, Jakarta is 23%. Further studies are needed to know the contributing factors including the usage of 'intravenous fluid' in relations to hypokalemic state during hospitalization.

**Key words:** hypokalemia, infectious diseases.

## INTRODUCTION

A low serum potassium concentration is perhaps the most common electrolyte abnormality encountered in clinical practice.<sup>1</sup> Hypokalemia is defined as a plasma  $K^+$  concentration below 3.5 mmol/L.<sup>2</sup> Moderate hypokalemia is a serum level of 2.5-3 mEq/L. Severe hypokalemia is defined as a level less than 2.5 mEq/L.<sup>3,4</sup> Patients with hypokalemia often have no symptoms, particularly when the disorder is mild (3.5-3 mEq/L). With more severe hypokalemia, nonspecific symptoms, such as generalized weakness, lassitude, and constipation, are more common. In severe hypokalemia, muscle necrosis can occur, and at serum concentrations of less than 2.0 mmol per liter, an ascending paralysis can develop, with eventual impairment of respiratory function.<sup>5</sup>

In the general population, data are difficult to estimate; however, probably less than 1% of people with no medications have a serum potassium level of lower than 3.5 mEq/L. Potassium intake varies according to age, sex, ethnic background, and socioeconomic status. Whether these differences in intake produce different degrees of hypokalemia or different sensitivities to hypokalemic insults is not known. Up to 21% of hospitalized patients have serum potassium levels lower than 3.5 mEq/L, with 5% of patients achieving potassium levels lower than 3 mEq/L.<sup>6</sup> Of elderly patients, 5% demonstrate potassium levels lower than 3 mEq/L. The majority of these patients have serum potassium concentrations between 3.0 and 3.5 mmol per liter, but as many as one quarter have values below 3.0 mmol per liter.

Comparable data are not available for outpatients, but a low serum potassium concentration has been found in 10 to 40 percent of patients treated with thiazide diuretics.<sup>7</sup> Hypokalemia is usually well tolerated in otherwise healthy people, but it can be life-threatening when severe. Even mild or moderate hypokalemia increases the risks of morbidity and mortality in patients with cardiovascular disease. As a result, when hypokale-

**Table 1. Electrolytes Composition of Each Infusion Solution Given**

Products	Na <sup>+</sup>	K <sup>+</sup>	Ca <sup>++</sup>	Cl <sup>-</sup>	Lactate <sup>-</sup>	Acetate <sup>-</sup>	Osm. Pressure (mOsm/L)	Volume (mL)	Package
RL	130	4	3	109	28		273	500	Plabottle
NS	154			154			308	500	Plabottle
RA	130	4	3	109		28	273	500	Plabottle

mia is identified, the underlying cause should be sought and the disorder treated.

Prevalence study of hypokalemia in hospitalized patients in Indonesia is rarely reported. Therefore, we perform this study in order to know the prevalence of hypokalemia that occurs in hospitalized patients, especially with infectious disease.

## METHODS

A cross sectional study was carried out in the internal medicine wards Cipto Mangunkusumo General Hospital in Jakarta. The study was carried out in the period between December 2005 and June 2006. Hospitalized patients with infectious disease and age more than 12 years who had replacement solution with baseline sodium concentration between 135 and 145 mEq/L were included. Exclusion criteria included shock, congestive heart failure, renal insufficiency, diarrhea, and diuretic usage. Serum potassium examination was performed twice, first on their admission and the second at discharge.

## RESULTS

### Demographic Data

Of 105 patients matched with all criteria, there were 44 men (41.9%) and 61 women (58.1%), with age range between 14 and 70 years. The day of hospitalization varies between three and thirty nine days.

### Types of Infections

The types of infections in all patients were varied, those including dengue fever 82 cases (78.1%), mixed infection between dengue and typhoid fever 6 cases (5.7%), mixed infection between dengue fever and pneumonia 4 cases (3.8%), typhoid fever 3 cases (2.9%), pneumonia 3 cases (2.9%), mixed infection between dengue fever and cholecystitis 1 case (1%), mixed infections between pneumonia and viral infection 1 case (1%), mixed infections between pneumonia and tuberculosis 1 case (1%), viral infection 1 case (1%), non-diabetic foot ulcer 1 case (1%), cholecystitis 1 case (1%), and urinary tract infection (UTI) 1 case (1%).

### Underlying Diseases

Thirty one patients had already had underlying diseases before the infections. They were hepatobiliary disorders in 25 cases (80.6%), hypertension 2 cases (6.5%), urinary tract disorders 1 case (3.2%), diabetes mellitus 1 case (3.2%), combination of hypertension and diabetes mellitus 1 case (3.2%), and combination of hypertension and chronic obstructive pulmonary disease (COPD) 1 case (3.2%).

### Types of Intravenous Fluid

All of 105 patients received "replacement solutions". Ninety six of them received Ringer Lactate (RL) (91.4%), 8 patients received normal saline(NS) (7.6%), and 1 patient received Ringer Acetate (RA) (1%).

For details, electrolytes containing of each infusion given, please see table 1.

### Laboratory Findings

On the day of admission 81 patients (77.1%) had normal serum potassium level, while 24 patients (22.9%) already in hypokalemic state (Prevalence data). Further data shown among the patients who had normal potassium level on the day of admission, 39 patients became hypokalemic at the end of hospitalization, while others remained normal. And among the patients who had hypokalemia on the day of admission, 16 patients remained hypokalemic at the end of hospitalization, while others became normal. In this study, no patient was found in hyperkalemic state. (Table 2)

**Table 2. Comparison of Serum Potassium Level at Admission and Discharge**

Patients Status	Admission	%	Discharge	%
Normokalemia	81	77.1	50	47.6
Hypokalemia	24	22.9	55	52.4
<b>Total</b>	<b>105</b>	<b>100</b>	<b>105</b>	<b>100</b>

The level of hypokalemia on admission ranged from 1.7 to 3.4 mEq/L (mean + SD : 3.11 + 0.37) and during hospitalization from 2.5 to 3.4 mEq/L (mean + SD : 3.13 + 0.25). Further data from 24 hypokalemic patients at the time of admission the the ratio of mild : moderate :

**Table 3. Level of Hypokalemia**

Hypokalemia	Admission	%	% (n=105)	Discharge	%	% (n=105)
Mild	21	87.5	20	42	76.4	40
Moderate	2	8.3	2	13	23.6	12
Severe	1	4.2	0.9	-	-	-
Total	24	100	22.9	55	100	52

severe hypokalemia was 22 : 2 : 1. And at discharge the ratio of mild to moderate hypokalemia becomes 19 : 6.

## DISCUSSION

From this study we found that the prevalence of hypokalemia was common among hospitalized patient, particularly with infectious disease problems). Study performed in The United States showed that up to 21% of hospitalized patients have hypokalemia, with 5% of patients achieving potassium levels lower than 3 mEq/L.<sup>6</sup> Compared to the study in the United States, the prevalence in our study is higher.

Several factors were thought to contribute to hypokalemia in this study, such as inadequate dietary intake and transcellular potassium shift.<sup>1,2,8,9,10</sup> In infectious diseases, especially dengue fever, nausea, vomiting, and anorexia were common symptoms. They resulted in conditions that make patient difficult to receive adequate dietary intake. The breakdown of tissues during infectious diseases releases potassium into the extracellular compartment, mitigating hypokalemia.<sup>1</sup> This condition is thought to influence the development of hypokalemia by raising the level of hypokalemia due to inadequate dietary intake. That is why we found most cases with mild hypokalemia.

The usage of lactate-containing solutions in dengue fever is thought to promote metabolic alkalosis in the body.<sup>1,11</sup> In this condition potassium shifts into intracell, thus results in low level of potassium in serum.

As discussed above, most patients in this study developed mild hypokalemia. This conditions showed no symptoms. Patients with moderate hypokalemia also showed no symptoms. One patient with severe hypokalemia showed only general weakness.

Further studies are to be performed, they are monitoring potassium losses, especially from the urine, potassium intake in infectious diseases, and study about correlation between each type of intravenous fluid and incidence of hypokalemia. These studies help establish the pathophysiologic mechanism and thus help formulate the differential diagnosis.

## CONCLUSION

Hypokalemia is one of the problems that should be considered in hospitalized patients. The prevalence of hypokalemia in hospitalized patients with infectious diseases in Cipto Mangkunkusumo Hospital, Jakarta on admission is 23%. Several factors are thought to contribute to the development of hypokalemia, such as inadequate dietary intake and transcellular potassium shift (Shown in this study that the trend of hypokalemia patients increased during hospitalization). Further studies needed to be performed are monitoring potassium losses, especially from the urine, potassium intake in infectious diseases, and about correlation between each type of intravenous fluid and prevalence of hypokalemia and its ratio. In the near future maintenance type infusion solution should be administered to average medical patients who are not able to ingest sufficient quantity of fluid and electrolyte orally, in order to avoid hypokalemia. Ideally maintenance infusion solution containing optimum sodium and potassium in amount to fulfill daily requirement should be used instead of replacement fluid.

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