

## HYPOKALEMIA IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION

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### Contribution

RI, AS conceived the idea and did manuscript writing. MI MFI and RU did data collection. YA did review and final approval of manuscript. All authors contributed equally.

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## ABSTRACT

**Objective:** To determine the frequency of hypokalemia in newly diagnosed patients with acute myocardial infarction.

**Methodology:** This cross sectional study was carried out in the Department of Cardiology, Hayatabad Medical Complex, Peshawar from February 1st to July 31, 2018. Patients of acute myocardial infarction (MI) with age of 40-90 years were included in the study consecutively and serum potassium level was measured. Patients were admitted and treated according to protocol. Blood was analyzed by single pathologist. Data was analyzed by SPSS 10.

**Results:** In this study 197 patients were included, 55.3% males and 44.7% females. Mean age of the patients was  $59.5 \pm 9.5$  years. Serum potassium level ranged from 2.5 to 5.5 mmol/L and mean serum potassium level was  $4.0 \pm 0.3$  mmol/L. Hypokalemia was recorded in 10.2% of patients.

**Conclusion:** Hypokalemia is not uncommon in patients with acute MI. Further studies are recommended on identifying its risk factors and short/long term outcomes before drawing future recommendations.

**Key Words:** Myocardial infarction, Potassium, Hypokalemia, Arrhythmias

## INTRODUCTION

Coronary Artery disease (CAD) is a global health problem in both genders and is a major cause of death in the technologically advanced countries. The relation of socioeconomic status and outcome of myocardial infarction (MI) is a well-established fact in western populations revealing that those with lower socioeconomic status suffer the most burden of the condition.<sup>1</sup> The prevalence of CAD is equally high in south Asia including Pakistan.<sup>2</sup> According to the most careful estimates based on sound scientific studies nearly 100, 000 suffered an acute MI in Pakistan in the calendar year 2002.<sup>3</sup>

Hypokalemia is a medical emergency and if not treated promptly, results in decreased cardiac output and peripheral perfusion presenting as arrhythmias and hypotension, that can lead to cardiac and respiratory arrest. Given the fact that untreated hypokalemia is associated with high morbidity and mortality, it is critical to recognize and treat this disorder promptly.<sup>4</sup> Alterations in serum potassium levels can have dramatic effects on cardiac cell conduction and can be evident as incidental findings on the 12-lead ECG or can precipitate potentially life-threatening dysrhythmias.<sup>5</sup>

The current guidelines recommend maintaining potassium level of 4-4.5 mmol/L in MI patients.<sup>6</sup> On the other hand, very recent clinical trials presented increased mortality with potassium level of >4.5 mmol/L.<sup>6,7</sup> Patients having acute MI with potassium levels between 3.5 and 4.5 mEq/L had lowest mortality.<sup>6,8,9</sup>

Our study is designed to determine the frequency of hypokalemia in our local population presenting with newly diagnosed MI. The idea behind this study is lack of local data on the subject. This study will give us fresh local data about hypokalemia in patients with MI and based on results of this study,; we can formulate future research strategies to combat the fatal problem of hypokalemia in the better management of local MI patients. Our study is designed to determine the frequency of hypokalemia in our local population presenting with newly diagnosed MI.

## METHODOLOGY

This cross sectional study was carried out in the Cardiology Department of Hayatabad Medical Complex, Peshawar from February 1st to July 31, 2018. Study design was descriptive cross-

sectional. Patients of acute myocardial infarction (MI) of either gender aged 40-90 years were studied consecutively. Patients with chronic kidney and liver disease as per medical record and patients on diuretics were excluded from the study.

Complete history and clinical examination was carried out on all subjects to exclude effect modifiers. A blood sample was drawn from all the patients and serum potassium levels were measured in the hospital (this was done free of cost from hospital laboratory). Any serum potassium level below 3.5 mmol/L was considered as hypokalemia. All the patients were managed as per ward and medicine protocols. All the aforementioned data including name, age, sex was documented in a pre-defined proforma and stringent exclusion criteria was followed to avoid confounders and bias in the study results. A single experienced pathologist having minimum of five years of experience analyzed the samples in the hospital laboratory.

Data was entered and analyzed in SPSS version 10. Mean + SD was calculated for numerical variables like age and serum potassium level. Frequencies and percentages was calculated for categorical variables like gender and hypokalemia. Hypokalemia was grouped on basis of age and gender to see the effect modifiers. Chi square was applied and a value of less than 0.05 was considered significant.

## RESULTS

Total of 197 adult patients having acute myocardial infarction were included in the study. Mean age was  $59.5 \pm 9.5$  years. Analysis of patients with respect to age revealed; 37(18.8%) patients were up to 50 years, 83(42.1%) patients were in age range 51-60 years, 77(39.1%) patients were in age range above 70 years. Out of 197 patients included in the study, there were 55.3% male patients and 44.7% female patients. Serum potassium level oscillated from 2.5 to 5.5 mmol/L with a mean of  $4.0 \pm 0.4$  mmol/L. Frequency of hypokalemia in patients with acute MI is shown in the table 1.

Hypokalemia was stratified with regards to different age groups and gender as shown in table 1. The elderly were more often to have hypokalemia as compared to younger patients ( $p$  value of  $<0.05$ ). There was no statistically significant inter gender difference with a  $p$  value of 0.327.

**Table 1: Demographic Variables of Patient Characteristics (n=197)**

Variables	Hypokalemia		P-value
	Present	Not Present	
<b>Age</b>			
Upto 50 years	0	37	0.000
51-60 years	6	77	
Above 60 years	14	63	
<b>Gender</b>			
Male	9	100	0.327
Female	11	77	

## DISCUSSION

Potassium balance is very important to prevent adverse outcomes in patients with cardiovascular disease. Several studies have demonstrated a relationship between low serum potassium levels and the risk of ventricular arrhythmias in patients with acute MI.<sup>10,11</sup> Based on these studies, experts and professional societies have recommended maintaining potassium levels between 4.0 and 5.0 mEq/L or even 4.5 to 5.5 mEq/L in acute MI patients.<sup>12,13,14</sup> However, the studies leading to the development of these guidelines had several limitations. First, they concentrated on post infarction ventricular arrhythmias, and were not properly powered to examine the relationship between potassium levels and mortality. The largest prior study included 1074 patients with acute MI and demonstrated a U-shaped relationship between potassium levels and early post infarction ventricular fibrillation events but lacked power to show an association between potassium level and mortality.<sup>15,16</sup> Second, most prior studies were conducted before routine use of  $\beta$ -blockers, reperfusion therapy, and early invasive approaches for patients with acute MI.<sup>10,11</sup>  $\beta$ -Blockers reduce the incidence of postinfarction mortality and sudden cardiac death; raise serum potassium levels (by blocking epinephrine-induced depression of potassium levels through  $\beta$ -receptor stimulation) and suppress hypokalemia-mediated ventricular arrhythmias.<sup>17,18,19</sup> Third, the rate and prognostic value of ventricular arrhythmias and cardiac arrest following acute MI is much lower in the current era of AMI management compared with 20 years ago.<sup>20</sup> Therefore, previous studies including patients with acute MI that led to development of current potassium guidelines may no longer apply to current acute MI patients with hypokalemia. The findings in our study regarding hypokalemia and serum mean K level is similar to the study by Goyal et al but is different from that by Choi et al.<sup>6,7</sup>

Insulin resistance is observed in acute phases of MI. Higher levels of insulin does facilitate shift of potassium in intracellularly. At admission high serum glucose level in patients of acute MI has been linked to increased in-hospital and long term mortality.<sup>21</sup> Serum K level is maintained by intra and extracellular shifts and renal excretion.<sup>14</sup> As eGFR decreases, serum potassium level increases. eGFR is an independent predictor of mortality and complications after MI.<sup>22</sup>

## CONCLUSION

Although not very common, but hypokalemia is prevalent among one tenth patients with acute MI. Further studies should be planned for identifying its risk factors and short/long term outcome before drawing future recommendations.

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