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A Hospital Based Prospective Study to Evaluate the Role of Hypokalemia in Acute Myocardial Infarction

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Abstract
Background: Acute myocardial infarction is one of the leading causes of death in the developed world. Hence; the present study was conducted for assessing the role of hypokalemia in acute myocardial infarction. **Materials & Methods:** A total of 100 patients with presence of AMI were enrolled. Complete demographic details of all the patients were obtained. Blood samples were obtained, and serum potassium levels were assessed using autoanalyzer. Normal serum potassium was defined as 3.5 - 5.5 meq/L. Serum potassium values less than 3.5 were categorized as hypokalemia, and values more than 5.5 were categorized as hyperkalemia. All the results were analysed by using SPSS software. **Results:** Mean potassium levels among AMI patients was 3.9 meq/L. Overall, Hypokalemia was present in 37 percent of the patients. Significant correlation was obtained while correlating arrhythmias and Hypokalemia. **Conclusion:** Hypokalemia is associated with poorer profile in AMI patients.
Key words: Potassium, Hypokalemia.

Introduction

Acute myocardial infarction is one of the leading causes of death in the developed world. The prevalence of the disease approaches three million people worldwide, with more than one million deaths in the United States annually. Acute myocardial infarction can be divided into two categories, non-ST-segment elevation MI (NSTEMI) and ST-segment elevation MI (STEMI). Unstable angina is similar to NSTEMI. However, cardiac markers are not elevated. An MI results in irreversible damage to the heart muscle due to a lack of oxygen. An MI may lead to impairment in diastolic and systolic function and make the patient prone to arrhythmias. In addition, an MI can lead to a number of serious complications. The key is to reperfuse the heart and restore blood flow[1-3].Long-term (hours to days) potassium homeostasis depends on renal potassium excretion. However, several tissues contribute to transient short-term (seconds to minutes) potassium homeostasis. Here, skeletal muscles play an important role primarily because skeletal muscles contain the largest single pool of potassium in the body. Thus, for an adult human subject it can be calculated that the potassium content of the total skeletal muscle pool is approximately 225 times larger than the total potassium content in plasma. Moreover, due to the large number of Na+/K+-ATPase (also known as Na+/K+ pumps) and K+ channels, the skeletal muscles possess a huge capacity for potassium exchange. Hence, for an adult human subject it can be calculated that if all Na+/K+ pumps are activated to maximum capacity for potassium uptake, the entire extracellular potassium pool can be cleared in less than 30 s. This mechanism can shift potassium from plasma to stores, causing hypokalemia within seconds to minutes[4-7]. Hence; the present study was conducted for assessing the role of Hypokalemia in Acute Myocardial Infarction.

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Materials & methods

The present study was conducted for assessing the role of Hypokalemia in Acute Myocardial Infarction. A total of 100 patients with presence of AMI were enrolled. Diagnostic ECG changes with characteristic ECG alterations consisting of were as follows:

i.   ST elevation:
- New ST elevation at the J point in two contiguous leads with the cut-points.
- ≥0.1mV in all leads other than leads V2–V3 where the following cut points apply. ≥0.2 mV in men ≥40 years; ≥0.25 mV in men <40 years, or≥ 0.15 mV in women.

ii.   ST depression and T wave changes:
- New horizontal or down-sloping ST depression ≥ 0.05 mV in two contiguous leads and/or T inversion ≥ 0.1 mV in two contiguous leads with prominent R wave or R/S ratio 1.

Complete demographic details of all the patients were obtained. Blood samples were obtained, and serum potassium levels were assessed using autoanalyzer. Normal serum potassium was defined as 3.5 - 5.5 meq/L. Serum potassium values less than 3.5 were categorized as hypokalemia, and values more than 5.5 were categorized as hyperkalemia[6].All the results were analysed by using SPSS software. Chi-square test was used for evaluation of level of significance.

Results

Mean age of the patients was 43.8 years. Out of 100 patients, 64 were males and 36 were females. Mean potassium levels among AMI patients was 3.9 meq/L. Overall, Hypokalemia was present in 37 percent of the patients. Significant correlation was obtained while correlating arrhythmias and Hypokalemia.

Table 1: Potassium levels among AMI patients

Potassium levels	Number
Mean	3.9
SD	1.3

Table 2: Incidence of Hypokalemia among AMI patients

Variable	Number of patients	Percentage
Hypokalemia	37	37

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Table 3: Correlation of arrhythmias and Hypokalemia

Arrhythmias	Hypokalemia present	Hypokalemia absent	p- value
Present	19	23	0.00 (Significant)
Absent	18	40	
Total	37	63	

Discussion

An acute ST-elevation myocardial infarction (STEMI) is an event in which transmural myocardial ischemia results in myocardial injury or necrosis. The current 2018 clinical definition of myocardial infarction (MI) requires the confirmation of the myocardial ischemic injury with abnormal cardiac biomarkers. It is a clinical syndrome involving myocardial ischemia, EKG changes and chest pain. An ST-elevation myocardial infarction occurs from occlusion of one or more of the coronary arteries that supply the heart with blood. The cause of this abrupt disruption of blood flow is usually plaque rupture, erosion, fissuring or dissection of coronary arteries that results in an obstructing thrombus. The major risk factors for ST-elevation myocardial infarction are dyslipidemia, diabetes mellitus, hypertension, smoking, and family history of coronary artery disease [6-9]. Hence; the present study was conducted for assessing the role of Hypokalemia in Acute Myocardial Infarction. In the present study, mean potassium levels among AMI patients was 3.9 meq/L. Overall, Hypokalemia was present in 37 percent of the patients. T G Clausen et al studied 408 patients with acute myocardial infarction. The serum concentration of potassium was assessed on admission. Episodes of ventricular fibrillation and/or ventricular tachycardia within the following 6 hours were registered. A significant positive correlation between hypokalemia and the incidence of malignant ventricular arrhythmias was demonstrated. Ongoing treatment with diuretics at the time of admission did not appear to be of any significance for the development of ventricular fibrillation or ventricular tachycardia. Out of 100 hypokalemic patients, only 33 were treated with diuretics. The main reason for hypokalemia in the early phase of an acute myocardial infarction is most likely an activation of the sympathetic nervous system leading to an influx of potassium from the extracellular to the intracellular body fluid compartment[10].

In the present study, significant correlation was obtained while correlating arrhythmias and Hypokalemia. Patel RB et al evaluated the association between potassium levels, cardiac arrhythmias, and cardiovascular death in patients with non-ST-segment elevation myocardial infarction or unstable angina. Potassium levels were measured in 6515 patients prior to randomization to receive either ranolazine or a placebo in the MERLIN-TIMI 36 trial. A seven-day continuous electrocardiographic assessment was obtained to determine the incidence of non-sustained ventricular tachycardia (NSVT) and ventricular pauses. NSVT lasting for at least eight consecutive beats occurred more frequently at potassium levels <3.5 mEq/L than at potassium levels $\geqslant$5 mEq/L (10.1 vs. 4.5%, p=0.03 for trend), whereas the inverse pattern was observed for ventricular pauses >3 s, which occurred more frequently at potassium levels $\geqslant$5 mEq/L than at potassium levels <3.5 mEq/L (5.9 vs. 2.0%, p=0.03 for trend). There was a U-shaped relationship between the potassium level at admission and both early and late risk of cardiovascular death. Compared with patients with potassium levels of 3.5 to <4 mEq/L, a potassium level <3.5 mEq/L was associated with an increased risk of cardiovascular death at day 14 (2.4 vs. 0.8%, HRadj 3.1, p=0.02) and at one year (6.4 vs. 3.0%, HRadj 2.2, p=0.01). The risk of cardiovascular death at one year was also significantly increased at potassium levels $\geqslant$4.5 mEq/L and a similar trend was noted at potassium levels $\geqslant$5 mEq/L. The lowest risk of cardiovascular death was observed in patients with admission potassium levels between 3.5 and 4.5 mEq/L.[11]

Conclusion

Hypokalemia is associated with poorer profile in AMI patients. However; further studies were recommended.

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