ISSN (P): 2347-3398; ISSN (O): 2277-7253

Asian Journal of Medical Research | Original Article

Measurement of serum potassium levels in patients with acute myocardial infarction

M Vinod Kumar[1], D Narayana Murthy[2]

[1]Associate Professor, Cardiology Department, Kamineni Institute of Medical Sciences and research centre, Hyderabad, Telangana.
[2]Assistant Professor, General Medicine, Kalinga Institute of Medical Sciences, Buvaneshwar, Odisha.

Abstract

Background: To assess serum potassium levels in patients with acute myocardial infarction. **Methodology:** Sixty- four adult patients with AMI of either gender was enrolled. Patients of AMI were put in group I and healthy control in group II. 5 ml venous blood samples were collected from anti-cubital vein under aseptic precautions on the day of admission within 12 hours. All the samples were sent for analysis in laboratory for the estimation of potassium level. **Results:** Age group <40 years had 17 males and 12 females in group I and 18 males and 10 females in group II and >40 years had 20 males and 15 females in group I and 22 males and 14 females in group II. The mean serum potassium level in group I was 3.40 mEq/L and in group II was 4.90 mEq/L. The difference was significant (P< 0.05). **Conclusion:** Changes in potassium levels might act as a predictor for assessing the prognosis. Patients with AMI had lower serum potassium level as compared to healthy control.

Keywords: acute myocardial infarction, hypokalemia, Healthy subjects.

INTRODUCTION

Serum K (sK) level is critical in cardiovascular diseases for the prevention of adverse events. Most of the body K is intracellularly located (98%), and a level of 3.5-5.3 mmol/L is maintained by intra and extracellular shifts and renal excretion.[1] Hypokalemia is defined as sK levels of <3.5 mmol/L and plays an important role in cardiovascular disease pathogenesis. Studies showed that at the acute phase of myocardial infarction (MI), hypokalemia occurs that as a consequence could lead to ventricular arrhythmia.[2,3]

Acute MI is accompanied by a catecholamine surge. Catecholamine by stimulating Na-K-ATPase pump shifts K intracellularly, thus causing redistributional hypokalemia, and as a result, non-ischemic myocardium is hyperpolarized. As a consequence, electrical inhomogeneity occurs and leads to ventricular arrhythmia.[4,5] Potassium homeostasis is critical to prevent adverse events in patients with cardiovascular disease. Several studies have demonstrated a relationship between low serum potassium levels, usually less than 3.5 mEq/L, and the risk of ventricular arrhythmias in patients with acute myocardial infarction (AMI).[6,7] We performed this study to assess levels of serum potassium levels in patients with acute myocardial infarction.

Address for correspondence*

Dr. D Narayana Murthy
Assistant Professor, General Medicine,
Kalinga Institute of Medical Sciences,
Buvaneshwar, Odisha.

METHODS

A sum total of sixty- four adult patients with AMI of either gender was enrolled. Ethical approval from review board and clearance committee was taken into consideration.

Demographic profile such as name, age, gender etc. was recorded. Patients of AMI were put in group I and healthy control in group II. 5 ml venous blood samples were collected from anti-cubital vein under aseptic precautions on the day of admission within 12 hours. All the samples were sent for analysis in laboratory for the estimation of potassium level. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table 1: Age wise distribution.

Age groups (years)	Gender	Group I	Group II
<40	Male	17	18
	Female	12	10
>40	Male	20	22
	Female	15	14

Age group <40 years had 17 males and 12 females in group I and 18 males and 10 females in group II and >40 years had 20 males and 15 females in group I and 22 males and 14 females in group II (Table 1).

Table 2: Serum potassium level in both groups

Groups	Mean (mEq/L)	P value
Group I	3.40	0.01
Group II	4.90	

DISCUSSION

An acute myocardial infarction (AMI) is a subset of a spectrum of IHD that includes unstable angina and AMI with or without ST elevation. Potassium is critical to the maintenance of cardio-vascular health.[8] Several studies have demonstrated a relationship between low serum potassium levels and the risk of ventricular arrhythmias in patients with AMI. Acute MI is accompanied by a catecholamine surge.[9,10] Catecholamine by stimulating Na-K-ATPase pump shifts K intracellularly, thus causing re-distributional hypokalemia, and as a result, non-ischemic myocardium is hyperpolarized. As a consequence, electrical inhomogeneity occurs and leads to ventricular arrhythmia.[11] Studies had proposed an increased rate of ventricular arrhythmia during the acute course of MI that was found to be associated with hypokalemia.[12] At least one cTn measurement should be greater than the 99th percentile normal reference limit during: symptoms of myocardial ischemia; new (or presumably new) significant ECG ST-segment/T-wave changes or left bundle branch block; the development of pathological electrocardiographic (ECG) Q waves; new loss of viable myocardium or regional wall motion abnormality identified by an imaging procedure; or identification of intracoronary thrombus by angiography or autopsy.[13] Research showed that at the acute phase of myocardial infarction (MI), hypokalemia occurs that as a consequence could lead to ventricular arrhythmia.14 Potassium mediates vasodilation by Na-K-ATPase pump and inwardly rectifying K channels. Also, K inhibits vasoconstriction associated with angiotensin-II. As a consequence, a low level of K further enhances infarction and ischemia.[4] Previous studies showed that hypokalemia is a fairly common finding on admission in acute MI patients. The mean admission level of sK was approximately 4 mmol/L. This level is not defined as hypokalemia. It was reported that after ischemic attack, during the stable phase, the sK level significantly increases with a mean value of 4.4 mmol/L.[15] We performed this study to assess levels of serum potassium levels in patients with acute myocardial infarction.

In our study age group <40 years had 17 males and 12 females in group I and 18 males and 10 females in group II and >40 years had 20 males and 15 females in group I and 22 males and 14 females in group II. Choi et al[16] demonstrated that mean sK level of >4.5 mmol/L is associated with increase in inhospital and long-term mortality. Even though in that study, the K level of >4.5 mmol/L group was less frequently treated with beta-blockers and angiotensin-converting enzyme inhibitors, after the adjustment of confounders, the mean sK level of >4.5 mmol/L was associated with increased long-term mortality.

Our results demonstrated that the mean serum potassium level in group I was 3.40 mEq/L and in group II was 4.90 mEq/L. Friedensohn A et al[17] assessed 11 patients presenting with AMI. 13% of the overall patients 11 studied had significant hypokalemia. The average initial level of potassium in patients who developed malignant arrhythmias was (4.10 mmol/liter) significantly lower than those patients who did not develop such arrhythmias (4.19 mmol/liter). It was determined that diabetics have a higher level of potassium than non-diabetics (4.2 mmol/liter versus 4.11 mmol/liter - P = 0.01) and a lower incidence of malignant arrhythmias. Singh et al[18] assessed levels of serum potassium levels in 100 acute myocardial infarction patients. Mean serum potassium levels were higher in the control group (4.52 mEq/L) in comparison to the study group (3.99 mEq/L).

Khan et al[19] found that serum potassium measured within 48 hours after hospital admission is often abnormal and increases during hospitalization in patients with heart failure. Given this, serum potassium on admission as well as post admission were investigated to account for the impact of related treatments. Interestingly, the magnitude of serum potassium levels at post admission was slightly stronger than on admission in the hyperkalemia groups (1.45 vs. 1.22, 2.12 vs. 1.50).

CONCLUSION

Changes in potassium levels might act as a predictor for assessing the prognosis. Patients with AMI had lower serum potassium level as compared to healthy control.

REFERENCES

1. Clausen TG, Brocks K, Ibsen H. Hypokalemia and ventricular arrhythmias in AMI. Acta Med Scand. 1988;224(6):531-7.
2. Solomon RJ. Ventricular arrhythmias in patients with MI and ischemia. The role of serum potassium. Drugs. 1986;31 Suppl 4:112-20.
3. Cohn JN, Kowey PR, Whelton PK, Prisant LM. New guidelines for potassium replacement in clinical practice: a contemporary review by the National Council on Potassium in Clinical Practice. Arch Intern Med. 2000;160(16):2429-2436.
4. Macdonald JE, Struthers AD. What is the optimal serum potassium level in cardiovascular patients? J Am Coll Cardiol. 2004;43(2):155-161.
5. Rogers WJ, Frederick PD, Stoehr E, et al. Trends in presenting characteristics and hospital mortality among patients with ST elevation and non-ST elevation myocardial infarction in the National Registry of Myocardial Infarction from 1990 to 2006. Am Heart J. 2008;156(6):1026-1034.
6. Herlitz J, Hjalmarson A, Bengtson A. Occurrence of hypokalemia in suspected AMI and its relation to clinical history and clinical course. Clin Cardiol. 1988 Oct;11(10):678-82.
7. Mroczek-Czernecka D. Metabolism of potassium in the acute phase of MI. Folia Med Cracov. 1990;31(1- 2):3-15.
8. Reddy K, Khaliq A, Henning RJ. Recent advances in the diagnosis and treatment of acute myocardial infarction. World J Cardiol. 2015;7(5):243–276.
9. Johansson BW, Dziamski R. Malignant arrhythmias in AMI. Relationship to serum potassium and effect of selective and non-selective beta-blockade. Drugs. 1984 Oct;28 Suppl 1:77-85.
10. Nordrehaug JE, von der Lippe G. Serum potassium concentrations are inversely related to ventricular, but not to atrial, arrhythmias in AMI. Eur Heart J. 1986 Mar;7(3):204-9.
11. Kafka H, Langevin L, Armstrong PW. Serum magnesium and potassium in AMI. Influence on ventricular arrhythmias. Arch Intern Med. 1987 Mar;147(3):465-9.
12. Gupta AK. Evaluation of serum potassium levels in acute myocardial infarction patients. Journal of Advanced Medical and Dental Sciences Research. 2015 Jul;3(3).

13. Uluganyan M, Ekmekçi A, Murat A, Avşar Ş, Ulutaş TK, Uyarel H, Bozbay M, Çiçek G, Karaca G, Eren M. Admission serum potassium level is associated with in-hospital and long-term mortality in ST-elevation myocardial infarction. Anatolian journal of cardiology. 2016 Jan;16(1):10.
14. Goyal A, Spertus JA, Gosch K, Venkitachalam L, Jones PG, Van den Berghe G, Kosiborod M. Serum potassium levels and mortality in acute myocardial infarction. Jama. 2012 Jan 11;307(2):157-64.
15. Bowling CB, Pitt B, Ahmed MI, et al. Hypokalemia and outcomes in patients with chronic heart failure and chronic kidney disease: findings from propensity-matched studies. Circ Heart Fail. 2010; 3(2):253-260.
16. Choi JS, Kim YA, Kim HY, Oak CY, Kang YU, Kim CS, et al. Relation of serum potassium level to long-term outcomes in patients with acute myocardial infarction. Am J Cardiol 2014; 113: 1285-90.
17. Friedensohn A, Faibel HE, Bairey O, Goldbourt U, Schlesinger Z. Malignant arrhythmias in relation to values of serum potassium in patients with AMI. Int J Cardiol. 1991;32(3):331-38.
18. Singh, Kosiborod M, Inzucchi SE, Krumholz HM, et al. Glucometrics in patients hospitalized with acute myocardial infarction: defining the optimal outcomes based measure of risk. Circulation. 2008;117(8): 1018-1027.
19. Khan SS, Campia U, Chioncel O, et al. Changes in serum potassium levels during hospitalization in patients with worsening heart failure and reduced ejection fraction (from the EVEREST trial). Am J Cardiol 2015; 115: 790–796.