Journal of Advanced Medical and Dental Sciences Research

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805 SJIF (Impact factor) 2017= 6.261; Index Copernicus value 2016 = 76.77

Original Article

Role of Serum Potassium in AMI Patients: A Prospective Study

Shilpa Kothavale[1], Jaywant Patil[2], G.S.Sansuddi[3], Sandhya Divekar[4], Gayithri Kulkarni[5], Harish Shriniwas Kulkarni[6]

[1,2]Reader, Department of General Medicine, [3]Professor, Department of Anatomy, [4]Reader, Department of Physiology, [5]Reader, Department of Oral Surgery, [6]Professor, Department of Oral Surgery, Tatyasaheb Kore Dental College and Research Centre, Kolhapur, Hatkanangale, Maharashtra, India

ABSTRACT:

Background: Acute myocardial infarction is one of the common cardiac problems affecting significant population worldwide. Because only about 2% of the total body potassium is present in the extracellular fluid, plasma potassium concentration has to be maintained within a narrow range to avoid excessive variations in the membrane voltage and its dangerous consequences.Hence; we conducted the present study to assess mean serum potassium levels in patients with AMI.**Materials & methods:** The present study included assessment of 20 patients with acute myocardial infarction and matched control group of 20 healthy individuals. All the patients of acute myocardial infarction fulfilling the inclusion and exclusion criteria were included in the present study. Estimation of levels of serum sodium and serum potassium was done. All the results were analyzed by SPSS software version 17.0.**Results:**Mean serum potassium levels in AMI patients in AMI group patients was 4.01 mEq/L while mean serum potassium levels in control group was 4.52 mEq/L. we observed significant results while comparing the mean serum potassium levels in between AMI group patients and control group patients.**Conclusion:**Potassium levels definitely show significant alteration in patients with AMI.

Key words: Acute myocardial infarction, Potassium, Serum

Received: 21 November 2017 Revised: 12 December 2017 Accepted: 22 December 2017

Corresponding author: Dr. Shilpa Kothavale, Reader, Department of General Medicine, Tatyasaheb Kore Dental College and Research Centre, Kolhapur, Hatkanangale, Maharashtra, India

This article may be cited as: Kothavale S, Patil J, Sansuddi GS, Divekar S, Kulkarni G, Kulkarni HS. Role of Serum Potassium in AMI Patients: A Prospective Study. J Adv Med Dent Scie Res 2018;6(1):11-13.

INTRODUCTION

According to WHO's definition, acute myocardial infarction (AMI) occurs if at least two of three criteria are fulfilled: typical ischaemic chest pain; raised concentrations of creatine kinase-MB in serum; and typical electrocardiographic findings, including development of pathological Q-waves.[1-3]Sodium and potassium have played key roles in the development and maintenance of essential cellular functions throughout more than 2 million years of human evolution. The Na+/K+ adenosine triphosphatase (sodium pump) present in all human cells generates potassium gradient across the cell membrane, which is the main determinant of the resting membrane potential. In general, changes in plasma potassium concentration are related inversely to changes in the negative voltage across cell membranes, and this in turn influences many crucial functions in the body, especially in excitable tissues such as nerve and muscle.[4-6] Because only about 2% of the total body potassium is present in the extracellular fluid, plasma potassium concentration has to be maintained within a narrow range to avoid excessive variations in the membrane voltage and its dangerous consequences.[7-9] Hence; we conducted the present study to assess mean serum potassium levels in patients with AMI.

MATERIALS & METHODS

The present study was planned in the department of General Medicine and included assessment of 20 patients with acute myocardial infarction who presented to the emergency department and fulfilled the inclusion criteria of the study and matched control group of 20 healthy individuals. Ethical approval was taken from institutional ethical committee in written and written consent was obtained from all the patients after explaining in detail the entire research protocol. For the control purpose, 20 normal non-hypertensive and non- diabetic persons with negative history of smoking, and without symptoms of AMI were carefully selected and examined in detail with age and gender matched, who were not obese, non-predisposed and physically active.All the patients of acute myocardial infarction fulfilling the inclusion and exclusion criteria were included in the present study. On admission, detailed history and thorough physical

examination of the patients was done. Routine baseline investigations i.e. Hb, TLC, DLC, PBF, FBS/RBS, lipid profile, Serum CK–MB, blood urea and serum creatinine were done. Estimation of levels of serum sodium and serum potassium was done. All the results were analyzed by SPSS software version 17.0. Chi- square test was used for assessment of level of significance. P- value of less than 0.05 was taken as significant.

RESULTS

A total of 40 subjects were included in the present study, out of which, 20 were with AMI and 20 were healthy controls. Mean serum potassium levels in AMI patients in AMI group patients was 4.01 mEq/L while mean serum potassium levels in control group was 4.52 mEq/L. we observed significant results while comparing the mean serum potassium levels in between AMI group patients and control group patients.

Table 1: Comparison of mean serum potassium levels in between the AMI group and the control group

Group	Study group	Control group	P- value
Mean Serum potassium levels (mEq/L)	4.01	4.52	0.004 (S)

S: Significant

DISCUSSION

In the present study, we observed that mean serum potassium levels were significantly lower in AMI patients in comparison to the healthy controls **(P- value < 0.05)**. Keskin M et al (2016) analysed retrospectively 3760 patients diagnosed with STEMI. Mean serum potassium levels were categorized accordingly: <3.0, 3.0 to <3.5, 3.5 to <4.0, 4.0 to <4.5, 4.5 to <5.0, 5.0 to <5.5, and ≥5.5mEq/L. The lowest mortality was determined in patients with serum potassium level of 4 to <4.5mEq/L whereas mortality was higher in patients with serum potassium levels of ≥5.0 and <3.5mEq/L. In a multivariable Cox-proportional regression analysis, the mortality risk was higher for patients with serum potassium levels of ≥5mEq/L. In-hospital and long-term mortality risks were also higher for patients with serum potassium levels of ≤3.5mEq/L. Conversely, ventricular arrhythmias were higher only for patients with serum potassium level of ≤3.5mEq/L. Furthermore, a significant relationship was found between the patient with serum potassium levels of ≤3.5mEq/L and ventricular arrhythmias.[10]Patel RB et al (2017) 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. The association between potassium levels and cardiovascular death was evaluated using a Cox proportional hazards regression model with multivariable adjustment. NSVT lasting for at least eight consecutive beats occurred more frequently at potassium levels <3.5 mEq/L than at potassium levels ⩾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 ⩾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 ⩾4.5 mEq/L and a similar trend was noted at potassium levels ⩾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. Both lower and higher levels of potassium were associated with tachyarrhythmias and bradyarrhythmias, suggesting a potential mechanistic explanation for the increased risk of cardiovascular death at the extremes of potassium homeostasis.[11]

Uluganyan M et al (2016) figured out the relation between admission serum potassium level and in-hospital and long-term mortality and ventricular arrhythmias Retrospectively, 611 patients with ST-elevation myocardial infarction (STEMI) who underwent primary percutaneous coronary intervention were recruited. Admission serum potassium levels were categorized accordingly: <3.5, 3.5-<4, 4-<4.5, 4.5-<5, and ≥5 mmol/L. The lowest in-hospital and long-term mortality occurred in patients with serum potassium levels of 3.5 to <4 mmol/L. The long-term mortality risk increased for admission serum potassium levels of >4.5 mmol/L. At serum potassium levels <3 mmol/L and ≥5 mmol/L, the incidence of ventricular arrhythmias was higher (p=0.019). Admission serum potassium level of >4.5 mmol/L was associated with increased long-term mortality in STEMI. A significant relation was found between serum potassium level of <3 mmol/L and ≥5 mmol/L and ventricular arrhythmias.[12]Madias JE et al (2000) evaluated the frequency, attributes, and outcome, and speculated on the mechanism of hypokalemia in patients with MI. This was a prospective cross-sectional study of 517 consecutive patients with MI admitted to the coronary care unit (CCU). Serum potassium was measured in the emergency department and repeatedly thereafter throughout hospitalization, and was used in the analysis, along with a large array of clinical and laboratory variables. The patients were allocated to a hypokalemia and a normokalemic cohort, based on the emergency department serum potassium measurement. The 41 patients with hypokalemia were comparable on admission in their baseline assessment to the 476 patients with normal serum potassium, except for lower emergency department magnesium and earlier

presentation after onset of symptoms. There was a poor correlation between serum potassium and magnesium on admission (r = 0.14). Peak creatine kinase (CK) and myocardial isomer of CK were higher in the hypokalemia patients. Management of the two cohorts was the same, except for a higher rate of use of magnesium, serum potassium supplements, and antiarrhythmic drugs in the hypokalemia patients. No difference was detected between the hypokalemia and normokalemic patients in total mortality, cardiac mortality, atrial fibrillation, and ventricular tachycardia, but ventricular fibrillation (VF) occurred more often in the hypokalemia patients. However, proportions of VF occurring in the emergency department, CCU, or wards in the two cohorts were not different, but they were higher during the time interval prior to emergency department admission in hypokalemia patients. Hypokalemia is seen in approximately 8% of patients with MI in the emergency department; hypokalemia is associated with low emergency department magnesium, and low serum potassium levels in the CCU and throughout hospitalization. Hypokalemia has no relationship to preadmission use of diuretics, it is associated with early presentation to the emergency department, and it is not a predictor of increased morbidity or mortality.[13]

CONCLUSION

Potassium levels definitely show significant alteration in patients with AMI. However; future studies are recommended for assessing the exact role played by potassium in the pathogenesis of AMI.

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Source of support: Nil **Conflict of interest:** None declared