

Serum Magnesium in Acute Myocardial Infarction and its Relation with Arrhythmias

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ABSTRACT

Background: Magnesium plays a key role in the pathogenesis of myocardial infarction and its complication like arrhythmia. Low serum magnesium levels are associated with decreased electrical stability and hence increased incidence of arrhythmias. Also it induces hyperlipidemia leading to accelerated plaque formation

Aim: To know the relationship between the serum magnesium levels and arrhythmias in patients with acute myocardial infarction.

Method: 60 consecutive patients meeting the inclusion and exclusion criteria were enrolled and their serum magnesium measured on day 1 and day 5.

Results: There is significant difference in Magnesium levels in patients with and without arrhythmias. ($p < 0.001$)

Conclusion: In acute myocardial infarction, patients with low magnesium levels are more prone to get arrhythmias. So magnesium treatment can be considered in patients of acute myocardial infarction with low magnesium levels.

Keywords: Magnesium; Myocardial Infarction; Arrhythmias

INTRODUCTION

Magnesium is one of the essential electrolyte of human body. It is pivotal in achieving electrical stability in cardiomyocytes. Moreover, low serum magnesium levels correlated with increased risk of atherosclerosis. Normal magnesium levels range between 1.6-2.4 mg/dL. This is kept in range by body's intricate yet simple homeostatic mechanism. Besides proteins, fats and carbohydrates, minerals are also essential to life. Minor changes in physiologic concentrations of these ions can have catastrophic results. Magnesium has been implicated in the pathogenesis of Acute Myocardial infarction and its complications like arrhythmias. It plays a pivotal role in other cardiovascular diseases as well by inducing hyperlipidemia and accelerated atherogenesis. It is chiefly responsible for the maintenance of the functional integrity and electrical stability of the myocardium. Myocardial magnesium concentration in patients with sudden cardiac death was found to be surprisingly low. Magnesium has a vital role in ventricular fibrillation, which causes sudden death in IHD. Perhaps another possible theory goes on to say that in the absence of magnesium ions, coronary vasculature undergoes vasospasm and leads to sudden cardiac death in IHD. Also myocardial infarction is one of the common causes of death at present where prognosis depends on multiple factor of which many still remain unexplained. This study is designed to know the relationship between serum magnesium levels and arrhythmias in patients with acute myocardial infarction.

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METHODOLOGY

Sixty cases of Acute Myocardial Infarction, admitted to medical unit 01 of Lahore General Hospital over 6 months from July 2018 to December 2018 were enrolled in the study according to the following criteria. This study was approved by the departmental Ethical Committee.

Inclusion criteria: Patients were diagnosed to have Acute Myocardial Infarction, only if they had 2 of the following characteristics:

1. Chest Discomfort.
2. ECG features of Acute Myocardial Infarction.
3. Elevation of Cardiac Enzymes.

Only those patients presenting to the hospital within 12 hours of the onset of symptoms were included in the study.

Exclusion criteria: Patients with hypokalemia. The principal aim of the study was to know the relation between level of serum magnesium and arrhythmias in patients with acute myocardial infarction who are presenting within 12 hours of onset of symptoms. Selected patients were subjected to detailed history and thorough physical examination and routine investigations like hemoglobin, Total leucocyte count, Urine examination, blood sugar, Blood urea, Serum creatinine, serum electrolytes, fasting lipid profile, cardiac enzymes and Echocardiography was done in all cases. Serum Magnesium level was done on Day-1 and Day-5 using colorimetric end point technique. Reference range for magnesium was taken between 1.6-2.4 mg/dL.

RESULTS

In this study of 60 cases, 48 were males and 12 were females with male to female ratio of 4:1. The maximum incidence of acute myocardial infarction was seen between

6th and 7th decades of life followed by fifth and sixth decades. In the study, smoking is the most common risk factor found in the patients with acute myocardial infarction. Cigarette smoking accelerates coronary atherosclerosis in both sexes and at all ages and increases the risk of thrombosis, plaque instability and myocardial infarction. Hypertension was found to be the second main risk factor (50%) for the development of acute myocardial infarction. In the present study, 30 cases (50% of cases) presented to hospital between 3-6 hours of onset of chest pain and 15 cases (25%) cases presented between 0 – 3 hours. The mean serum magnesium level on day-1 in all 60 patients was 1.78±0.32 and the mean serum magnesium level on day-5 was 2.32±0.44. Out of 60 patients 30 patients had significant ventricular premature contractions/ventricular tachycardia/ventricular fibrillation during their 5-days course in the hospital. The mean value of serum magnesium on day-1 those with arrhythmias is 1.58±0.26 those without arrhythmias is 2.10±0.4 (p<0.001). There is a significant difference in the magnesium level in patient with arrhythmias and without arrhythmias. The mean value of serum magnesium on day-1 those with arrhythmias is 1.58±0.26 those without arrhythmias is 2.10±0.4 (p<0.001). There is a significant difference in the magnesium level in patient with arrhythmias and without arrhythmias.

DISCUSSION

Magnesium ion has emerged as a premier cardiovascular cation during the decade. It has been implicated in the pathogenesis of acute myocardial infarction and complication like arrhythmias. Magnesium is essential for activation of ATP, which maintains the sodium-potassium pump and also because of calcium blocking action magnesium has been implicated in relation to arrhythmias after acute myocardial infarction.

In the study group of 60 patients, 45 were males and 15 were females with a male-female ratio of 4:1. The maximum incidence of acute myocardial infarction was seen in the 6th and 7th decades. In the present study of 60 patients, the mean serum magnesium level on day-1 in all 60 patients was 1.78±0.32 and the mean serum magnesium level on day-5 was 2.32±0.44. Abraham et al¹ reviewed magnesium level of 65 consecutive patients with an admission diagnosis of acute myocardial infarction. Serum magnesium concentration were low in patient who had AMI (mean 1.70 mg/dl, p<0.001) or acute coronary insufficiency (mean 1.61 mg/dl, p<0.01), but not in the control group or patients with non-cardiac chest pain (mean 1.91 mg/dl).

Singh A et al² checked serum magnesium levels of twenty patients of acute myocardial infarction on the 1st, 7th and 12th day of admission. In all the cases, there was a significant fall of serum magnesium on the first day. Dimtruk³ in his series of 67 patients of ischemic heart disease showed a distinct reduction of plasma magnesium during the first 3 days following onset of disease, the level normalized by 15-25 days from onset of the disease. Sachdev et al⁴ (1978) in 30 patients of myocardial infarction determine the magnesium levels within 24 hours, 5th and 8th day and reported as 1.83±0.087 mgm%, 1.91±0.149 and 1.97±0.089 as against control of 2.44±0.162mgm%.

The values were statistically lower on all the three days showing a progressive rise.

In the present study, the serum magnesium level on day-1 was significant lower in patients with arrhythmias than those without arrhythmia (p<0.001). There was an increase in serum magnesium from Day-1 to Day-5 in both those with arrhythmias and those without arrhythmias. Ceremuzynski et al⁵ assigned 48 patients with acute myocardial infarction over 24 hours infusion of magnesium or placebo. The incidence of ventricular tachycardia (3 or more consecutive premature ventricular contraction at a rate faster than 120/ min) recorded by Holter monitoring was significantly reduced (p<0.001), but the incidence of other ventricular arrhythmias was not statistically different.

Raismusen et al randomized 273 patients with suspected acute myocardial infarction to intravenous magnesium or placebo. There is a significant decrease in the ventricular arrhythmia in the magnesium group compared to placebo (p<0.05). Shecter et al⁶ randomized 103 patients with documented acute myocardial infarction to 48 hours infusion of magnesium or placebo. There is a significant decrease in mortality (p<0.01). There was also a non-significant decrease in the number of tachyarrhythmias requiring treatment (10/50) in the magnesium group compared to control (24/53). Smith et al⁷ randomized 400 patients with suspected AMI to a hours infusion of magnesium sulphate or placebo. Two hundred patients had confirmed acute myocardial infarction. The difference in mortality and incidence of ventricular dysarrhythmia requiring treatment between magnesium and placebo groups were not statistically significant.

Abraham et al⁸ randomly assigned 94 patients with acute myocardial infarction to receive a daily magnesium bolus of 30 mmol or placebo for 3- days. There was no significant difference in mortality or lethal arrhythmias between patients treated with magnesium and those treated with placebo.

Felstedt et al⁹ randomized 298 patients with suspected acute myocardial infarction to 24 hours infusion of magnesium or placebo.

Myocardial infarction was documented in 162 patients. During the mean 72 observation period of 245 days, there was no difference in the incidence of tachyarrhythmias, magnesium infusion was associated with a significant increase in bradyarrhythmias. Singh et al¹⁰ randomized 264 patients with suspected acute myocardial infarction to magnesium, potassium, 10% glucose or 2% glucose infusion. Myocardial infarction was confirmed in 228 patients. Mortality and ventricular tachycardia or fibrillation did not differ significantly between the magnesium group and placebo group.

Morton et al¹⁰ randomized 76 patients to receive either magnesium infusion 0.38 mmol/l per kg every 12 hour or placebo over the first 36 hours of hospital, there was no difference in the incidence of ventricular tachycardia.

Dyckner T et al⁷ during their 11/2 years, 905 admission, 342 with acute myocardial infarction, 563 other diagnoses were treated in the CCU on admission both acute myocardial infarction and non AMI group had significantly lower serum magnesium level than as reference group. The incidence of serious ventricular premature beats, ventricular tachycardia and ventricular

fibrillation on admission was significantly higher in the hypomagnesemic patients with acute myocardial infarction.

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