



ROLE OF SERUM MAGNESIUM IN ACUTE MYOCARDIAL INFARCTION AND ITS RELATION TO ARRHYTHMIAS

General Medicine

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ABSTRACT

Background: The pathophysiology of Myocardial infarction and its complications, such as arrhythmia, are greatly influenced by magnesium. Low levels of serum magnesium are linked to decreased electrical stability and a higher occurrence of arrhythmias. Additionally, it causes hyperlipidaemia, which speeds up plaque development. **Aim:** To know the relationship between the serum magnesium levels and arrhythmias in patients with acute myocardial infarction. **Materials and methods:** This study is done in 60 consecutive patients admitted in Cardiology Ward and Intensive Care unit between February 2021 to August 2022, Narayana Medical College, Nellore. 60 consecutive patients meeting the inclusion and exclusion criteria were enrolled and their serum magnesium measured on day 1 and day 5. Results were analysed. **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

INTRODUCTION:

One of the vital electrolytes in the human body is magnesium. It is essential for cardio myocytes to achieve electrical stability. Furthermore, a higher risk of atherosclerosis was associated with decreased serum magnesium levels. Magnesium levels should be between 1.6 and 2.4 mg/dL.

The body's complex yet straightforward homeostatic process controls this. Minerals, in addition to proteins, lipids, and carbs, are necessary for life. The consequences of even little variations in the physiologic concentrations of these ions can be disastrous. The pathophysiology of acute myocardial infarction and its consequences, such as arrhythmias, have been linked to magnesium. By causing hyperlipidaemia and accelerating atherogenesis, it also plays a crucial part in other cardiovascular disorders. It is primarily in charge of preserving the myocardium's structural integrity and electrical stability.

Surprisingly low myocardial magnesium content was observed in patients who had suffered abrupt cardiac death. In ventricular fibrillation, which results in sudden mortality in IHD, magnesium plays a critical role. Another hypothesis might go on to state that in IHD, coronary vasculature experiences vasospasm in the lack of magnesium ions, which results in abrupt cardiac death. This investigation aims to determine the association between acute myocardial infarction patient arrhythmias and serum magnesium levels.

AIM:

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

OBJECTIVES:

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

STUDY DESIGN: Prospective observational study.

STUDY SETTING: All patients were prospectively enrolled from the Cardiology Ward and Intensive Care Unit at Narayana Medical College, Nellore

STUDY SUBJECTS: 60 patients with acute Myocardial Infarction admitted to Intensive Care Unit in the Cardiology and Intensive care unit meeting the Inclusion and Exclusion Criteria.

SAMPLE SIZE: 60

STUDY PERIOD: JULY 2021 to AUGUST 2022.

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 who have Hypokalemia.

Patients who presented with onset of symptoms more than 12 hours

Patients who are already known case of Coronary Artery Disease.

PROCEDURE:

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 haemoglobin, 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.

Ethical clearance: Before collection of data, all subjects were briefed about the purpose of the study and written informed consent was obtained. All investigations were done free of cost and no financial burden imposed on the patient. Ethical clearance was obtained from the institutional ethics committee.

Statistical analysis: Statistical analysis was carried out for 60 subjects. Age, sex, BMI, diabetes, hyper tension, dyslipidaemia, obesity, Serum Magnesium Levels Results were expressed as Mean and Standard Deviation (SD).

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, patients with acute myocardial infarction most frequently had smoking as a risk factor. Smoking cigarettes accelerates the development of coronary atherosclerosis in people of all ages and

genders and raises the danger of thrombosis, unstable plaque, and myocardial infarction. The second biggest risk factor for the development of an acute myocardial infarction was discovered to be hypertension (50%) In the current study, 15 cases (25%) and 30 cases (50%) of patients presented to the hospital between 0 and 3 hours after the onset of their chest symptoms, respectively. All 60 patients had a mean serum magnesium level of 1.78 ± 0.32 on day 1 and a mean serum magnesium level of 2.32 ± 0.44 on day 5.

During their five days in the hospital, 30 patients out of 60 patients experienced substantial ventricular premature contractions, ventricular tachycardia, and ventricular fibrillation. On day 1, those with arrhythmias had a mean serum magnesium level of 1.58 ± 0.26 , while those without arrhythmias had a mean level of 2.10 ± 0.40 ($p = 0.001$). Magnesium levels in patients with arrhythmias and those who do not differ significantly. On day 1, those with arrhythmias had a mean serum magnesium level of 1.58 ± 0.26 , while those without arrhythmias had a mean level of 2.10 ± 0.40 ($p = 0.001$). Magnesium levels in patients with arrhythmias and those who do not differ significantly.

Serum magnesium levels in patients with Arrhythmias

SERUM MAGNESIUM (mg/dl)	Day - 1	PERCENT	DAY - 5	PERCENT
< 1.6	12	20%	6	10%
1.6 to 2.50	18	30%	24	40%
>2.5	-	-	-	-

Serum magnesium levels in patients with Arrhythmias

Serum magnesium(mg/dl)	Day 1	PERCENT	DAY 5	PERCENT
<1.6	6	10%	-	-
1.6 – 2.5	18	30%	21	35%
>2.5	6	10%	9	15%

Mean Serum Magnesium Levels

	DAY 1	DAY 5
Mean serum Mg in 60 cases	1.78 ± 0.32	2.32 ± 0.44
Mean serum Mg level in patients with arrhythmia (30 patients)	1.58 ± 0.30	1.96 ± 0.32



DISCUSSION:

During the past ten years, magnesium ion has become a leading cardiovascular cation. It has been linked to the development of complications such as arrhythmias and acute myocardial infarction. Magnesium is necessary for ATP activation, which keeps the sodium-potassium pump functioning. Additionally, due to its calcium-blocking properties, magnesium has been linked to arrhythmias following acute myocardial infarction.

The male-to-female ratio in the study group of 60 patients was 4:1, with 48 men and 12 women. The sixth and seventh decades saw the highest rates of acute myocardial infarction. In the current investigation, the average serum magnesium level in the 60 patients was 1.78 ± 0.32 on day 1 and 2.32 ± 0.44 on day 5 of the study.

Abraham et al.¹ evaluated the magnesium levels of 65 patients who had an acute myocardial infarction as their admission diagnosis. In contrast to the control group and patients with non-cardiac chest pain (mean 1.91 mg/dl), patients with AMI or acute coronary insufficiency had serum magnesium concentrations that were low (mean 1.70 mg/dl, $p < 0.001$) or 1.61 mg/dl, $p = 0.01$, respectively.

Singh A et al² - Twenty patients with acute myocardial infarction had

their serum magnesium levels evaluated by Singh A et al² on the first, seventh, and twelfth days after admission. On the first day, the serum magnesium level significantly decreased in each patient. In his series of 67 individuals with ischemic heart disease,

Dimitruk³ found that the level of plasma magnesium decreased noticeably within the first three days of the disease's inception and then returned to normal between 15 and 25 days later. In 30 myocardial infarction patients,

Sachdev et al.⁴ (1978) measured the levels of magnesium within 24 hours, on days 5 and 8, and reported that they were 1.83 mg/dL, 1.91 mg/dL, and 1.97 mg/dL, respectively, compared to a control value of 2.44 mg/dL. The values were statistically lower on all the three days showing a progressive rise.

In the current investigation, individuals with arrhythmias had significantly lower serum magnesium levels on day 1 than patients without arrhythmia ($p < 0.001$). From Day 1 to Day 5, serum magnesium levels rose in both arrhythmia- and arrhythmia-free individuals.

Ceremuzynski et al.⁵ 48 individuals with acute myocardial infarction were given a magnesium infusion or a placebo over the course of 24 hours by Ceremuzynski et al. By using Holter monitoring, the prevalence of ventricular tachycardia—defined as three or more consecutive premature ventricular contractions occurring at a rate greater than 120 beats per minute—was significantly decreased ($p < 0.001$), but the prevalence of other ventricular arrhythmias did not differ statistically.

Raismusen et al⁶ - 273 patients with suspected acute myocardial infarction were randomly assigned to either intravenous magnesium or a placebo. Comparing the magnesium group to the placebo group, there is a statistically significant reduction in ventricular arrhythmia ($p < 0.05$). 103 individuals with a verified acute myocardial infarction were randomly assigned by

Shechter et al.⁷ to receive a 48-hour magnesium infusion or a placebo. Mortality has decreased significantly ($p < 0.01$). Additionally, the magnesium group had a non-significantly lower number of tachyarrhythmias that needed treatment (10/50) than the control group (24/53) did (10/50).

Smith et al⁸ 400 suspected AMI patients were randomly assigned by Smith et al. to receive a magnesium sulphate infusion for an hour or a 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.

Dyckner T et al⁹ 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 hypomagnesemia patients with acute myocardial infarction.

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.

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