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Original Research Article

An evaluation of the serum magnesium levels in acute myocardial infarction: a hospital based cross sectional study

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ABSTRACT

Background: Magnesium has been implicated in the pathogenesis of acute myocardial infarction and its complication like arrhythmia. Magnesium improves myocardial metabolism, inhibits calcium accumulation and myocardial cell death. Objective was to know the relationship between the serum magnesium levels and arrhythmias in patients with acute myocardial infarction.
Methods: It was a hospital based cross sectional study. By using simple random method, 50 cases of acute myocardial infarction, admitted in a tertiary care hospital in Chennai for the period of two years. Simple descriptive analysis was done to find out frequencies and percentages. For the test of significance the Chi-square test was used.
Results: In our study group of 50 subjects, 28 (56%) of patients developed arrhythmias and 22 (44%) of patients recovered without any complications. Variation in type of Myocardial Infarction among our study 50 patients were 22 (44%) had anterior wall MI, 21 (42%) patients had Inferior wall MI and 7 (14%) patients had anteroseptal MI. The mean Mg level for the arrhythmias patients for the day 1 and day 5 were 1.70±0.16 and 1.76±0.51 and 2.10±0.19 and for patients without arrhythmias 2.26±0.20. There is a significant difference in the magnesium levels in patients with arrhythmias and without arrhythmias.
Conclusions: In acute myocardial infarct ion, patients with low magnesium levels are more prone to get arrhythmias. So magnesium treatment can be considered in patients of acute myocardial infarct ion with low magnesium levels.

Keywords: Arrhythmias, Magnesium, Metabolism, Myocardial infarction

INTRODUCTION

Magnesium has been implicated in the pathogenesis of acute myocardial infarct ion and its complications like arrhythmias. It plays a significant role in other cardiovascular diseases as well. Magnesium ions are considered essential for the maintenance of the functional integrity of the myocardium.[1]

Myocardial magnesium concentration in patients with sudden death due to ischemic heart disease was found to be very low.[2] It has been pointed out that magnesium has a vital role in ventricular fibrillation, which causes sudden death in IHD. The coronary vasospasm resulting from magnesium deficiency has been suggested as another important factor in the sudden death of IHD.

Magnesium deficiency was also postulated to have role in the genesis of atheromatous plaques in that it leads to hyperlipidemia. Also myocardial infarct ion 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.

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.

METHODS

It was a hospital based cross sectional study conducted in a tertiary care hospital (Meenakshi Medical College and Hospital), Chennai, Tamil Nadu, India. Sample size and sampling was done by using the simple random method, the 50 cases of acute myocardial infraction, admitted over a period of 2 years (2017 December to 2019 December).

Inclusion criteria for patients were those patients presenting to the hospital within 12 hours of onset of symptoms were taken. Patients were considered to have acute myocardial infarction, only if they had 2 of the following criteria: History of chest discomfort, ECG changes of acute myocardial infarction, rise of cardiac enzymes. Regarding the exclusion criteria patients with hypokalemia. Cases selected were subjected to a detailed history and thorough physical examination, routine investigation like hemoglobin, blood count, urine examination, blood sugar, blood urea, serum creatinine, serum electrolytes, fasting lipid profile, cardiac enzymes and echocardiography was performed in all cases.

Study procedure

Serum magnesium level were estimated on day-1 and day-5.

Method of serum magnesium estimation method is Colorimetric end point test. The Reagent used is Xylidyl blue reagent and the Magnesium standard is 2.5 mg/dL. At alkaline pH magnesium reacts with xylidyl blue and produces a chelating red colored compound. The red increasing (or) the blue decreasing color are proportional to magnesium concentration. Non-hemolyzed serum or lithium hepar in plasma may be analyzed since the magnesium concentration inside erythrocytes is 10 times greater than that in the ECF, hemolysis should be avoided and serum should be separated from the cell as soon as possible. Reference range for magnesium is 1.6 - 2.4 mg/dl.

Statistical analysis

Data was entered in Ms excel sheet and imported into SPSS 18. Software for analysis. Simple descriptive analysis was done to find out frequencies and percentages. For the test of significance the Chi-square test was used.

RESULTS

In our study out of 50 cases, the maximum incidence of acute myocardial infarct ion was seen above 5th decade, followed by 4th decade. 52% patients were in the age group of more than 5th decade, 32% were in the age group of 40-49. Regarding gender distribution 31 (62%) were males and 19 (38%) were female patients. About 44 (88%) were Hindus, 5 (10%) were Muslims, 1 (2%) were Christian. The higher incidence of acute myocardial infarction is factual one but reflects the difference in population.

Diet pattern 44 (88%) were Non- vegetarian by diet and 6 (12%) of them consumed vegetarian diet. Non vegetarian run higher risk of acute myocardial infarct ion owing to their higher content of cholesterol in their diet compared to the vegetarian. Regarding risk factors, smoking is the most common risk factor found in patients with acute myocardial infarction. In our study group 40% of subjects are smokers. About, 28 (56%) were found to be obese. Circumference was measured in all patients, men whose waist circumference is more than 102 cm and females whose waist circumference is more than 88cms were considered to be obese. Almost 34 (68%) were found to be hypertensive and 30 (60%) patients were found to be diabetic and 32 (64%) patients were found to be dyslipidemic.

Table 1: Variations in type of myocardial infraction.

ECG diagnosis	Frequency	Percentages
Anterior wall MI	22	44
Antero septal MI	7	14
Inferior wall MI	21	42

In our study group of 50 subjects, 28 (56%) of patients developed arrhythmias and 22 (44%) of patients recovered without any complications. Arrhythmias included occasional VPCs and Ventricular tachycardia. Variation in type of Myocardial Infarction among our study 50 patients were 22 (44%) had Anterior wall MI, 21(42%) patients had Inferior wall MI and 7 (14%) patients had anteroseptal MI (Table 1).

The serum magnesium levels in patients with arrhythmias and without arrhythmias. The mean Mg level for the arrhythmias patients for the day 1 and day 5 were 1.70±0.16 and 1.76±0.51.

For the patients without arrhythmias for day1 and day 5 were 2.10±0.19 and 2.26±0.20. There is significant difference in patient with arrhythmias and without arrhythmias ($p<0.001$). Mortality of patients, 2 patients died during their 5 days hospital course. Both the patients died of Ventricular tachycardia. Mortality percentage was 4% (Table 2).

Table 2: Comparison of magnesium levels of patients with and without arrhythmias.

Comparison of magnesium levels	Complication	Frequency	Mean mg level	P value
Day 1 magnesium level	With arrhythmias	28	1.70±0.16	0.001
	Without arrhythmias	22	2.10± 0.19	
Day 5 magnesium level	With arrhythmias	28	1.76±0.51	
	Without arrhythmias	22	2.26±0.20	

DISCUSSION

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

Abraham et al reviewed magnesium level of 65 consecutive patients with an admission diagnosis of acute myocardial infarction.[10] 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 et al checked serum magnesium levels of twenty patients of acute myocardial infarct ion on the 1st, 7th and 12th day of admission.[4] In all the cases, there was a significant fall of serum magnesium on the first day.

Dimtruk et al 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.[5] Sachdev et al in 30 patients of myocardial infarct ion 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±0.162 mgm%. 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 al assigned 48 patients with acute myocardial infarction over 24 hours infusion of magnesium or placebo.[7] The incidence of ventricular tachycardia (3 or more consecutive premature ventricular contract ion 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.

There is a significant decrease in the ventricular arrhythmia in the magnesium group compared to placebo (p<0.05). Shecter et al randomized 103 patients with documented acute myocardial infarct ion to 48 hours infusion of magnesium or placebo.[8] There is a significant decrease in mortality (p<0.0 1). 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 al randomized 400 patients with suspected AMI to a 24 hours infusion of magnesium sulphate or placebo.[9] Two hundred patients had confirmed acute myocardial infarction. The difference in mortality and incidence of ventricular dysarrhtymia requiring treatment between magnesium and placebo groups were not statistically significant. Abraham et al randomly assigned 94 patients with acute myocardial infarct ion to receive a daily magnesium bolus of 30 mmol or placebo for 3- days.[10] There was no significant difference in mortality or lethal arrhythmias between patients treated with magnesium and those treated with placebo.

CONCLUSION

In the study group mean serum magnesium level in 28 patients with arrhythmia is 1.70±0.16 on day-1 and 1.76±0.51 on day-5. The mean serum magnesium level in 22 patients without arrhythmia is 2.10±0.19 on day-1 and 2.26±0.20 on day-5. The difference between the magnesium level in patients with arrhythmia and without arrhythmia is statically significant on both day-1 and day-5.

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