



“STUDY ON SERUM MAGNESIUM LEVELS AND INCIDENCE OF ARRHYTHMIAS IN PATIENTS PRESENTING TO EMERGENCY DEPARTMENT WITH ACUTE MYOCARDIAL INFARCTION”

Emergency Medicine

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ABSTRACT

Background; Magnesium has been implicated in the pathogenesis of acute myocardial infarction and its related complication like arrhythmia. Magnesium helps in myocardial metabolism, inhibits calcium accumulation and myocardial cell death. It has role in improving the vascular tone, peripheral vascular resistance, after load and cardiac output, reduces cardiac arrhythmias and improves lipid metabolism. Magnesium reduces vulnerability to oxygen derived free radicals, improves endothelial function and inhibits platelet function including platelet aggregation and adhesion. **Objective:** To know the relationship between the serum magnesium levels and arrhythmias in patients with acute myocardial infarction. 70 cases of acute myocardial infarction, admitted in a tertiary care hospital over a period of 2 years i.e., between October 2015 to October 2017. **Results:** There is a significant difference in the magnesium levels in patients with arrhythmias and without arrhythmias. **Conclusion:** In acute myocardial infarction, patients with low magnesium levels are more prone to get arrhythmias. That is the reason magnesium treatment can be considered in patients of acute myocardial infarction with low magnesium levels.

KEYWORDS

Magnesium; Myocardial infarction; Arrhythmias.

INTRODUCTION

Coronary artery disease is one of the the most important cause of death and is more from CVDs than from any other cause. An around 17.7 million people died from CVDs in 2015, representing 31% of all global deaths. Of these deaths, 7.4 million were due to coronary heart disease. Globally is common in low- and middle-income countries [1]. There are many risk factors are implicated for this rise, ranging from cigarette smoking, hypertension, diabetes mellitus, and obesity to various psychosocial stresses imposed by social dynamics and urbanisation [1]. Acute Myocardial Infarction (MI) is occurs when there is biochemical evidence of myonecrosis in a patient with chest pain suggestive of coronary ischaemia for prolonged period (>30 min). Hypomagnesemia is an electrolyte disturbance in which there is low level of magnesium in blood [2]. Magnesium is an essential micronutrient for human beings and it has an important role in normal myocardial physiology. It's a cofactor in more than 300 enzymes system of the body in human cell. It acts on vascular smooth muscle, platelets, and myocardial cells [3]. hypomagnesemia can induce hyperlipidemia and subsequently atherogenic deposits in coronary arteries leading to atherosclerosis [4]. Normal magnesium level fall between 1.7 and 2.2 mEq/L. Usually, a serum level < 1.7 mEq/L is taken as reference. Magnesium has been known to have an influence in the causation of acute myocardial infarction and also its sequelae like arrhythmias [5]. Several investigations have shown that the serum magnesium level is low in the first 48 hours following an acute myocardial infarction and later it increases gradually to attain the normal level in about three weeks time. Infarcted myocardium was found to have reduced magnesium concentration. The above said findings correlated directly with the associated complications of acute myocardial infarction, such as arrhythmias. In patients with sudden death because of ischemic heart disease, magnesium concentration in the cardiac muscle was found to be decreased [5].

Hypo-magnesium acts a provoking factor in the occurrence of ventricular fibrillation, which is usually the cause of sudden death in IHD. The coronary vasospasm which occurs as a result of hypomagnesemia has been considered as an important factor in the cause of sudden death in IHD [5]. A considerable number of people are suffering from IHD which includes AMI in India. Morbidity and mortality from its complications are also very high. So our effort should be directed at prevention of these diseases as well as their complications. The relationship between Mg and IHD is becoming clear day by day from the different studies done around the world. But there are very trials in india. The present research was thus conducted to know the relation between level of serum magnesium and arrhythmias in patients with acute MI, presenting within 12 hours of onset of symptoms.

AIMS AND OBJECTIVES

Primary Objective

To know the relation between level of serum magnesium and arrhythmias in patients with acute myocardial infarction.

Secondary Objective

1. To evaluate the level of serum magnesium in cases of acute myocardial infarction with and without arrhythmias.
2. To assess the prognostic efficacy of serum magnesium for predicting development of arrhythmias in cases of acute myocardial infarction.

METHODOLOGY

It is an prospective observational study conducted from 2015 to 2017. Study conducted in the department of Emergency Medicine at a tertiary care hospital, patients presenting with acute myocardial infarction within 12 hours of onset were taken. After fulfilling the inclusion and exclusion criteria informed consent, 70 patients fulfilling the eligibility criteria were taken for the study. Sample Size Calculation: The sample size was calculated using following formulae:
 $n = (Z\alpha/2)^2 * p(1-p) / E^2$
 n- Sample size
 $Z\alpha/2$ - Z value at 5% error (1.96)
 P- Prevalence of arrhythmias among AMI cases (taken as 45%, based on study by Makoui HR et al. [6])
 E - absolute error (taken as 15%)
 $n = (1.96)^2 * (0.45 * 0.55) / (0.15)^2$
 n- 43 (minimum) We decided to take all eligible cases coming to our hospital during study duration. The final sample was thus 70 cases of AMI.

Ethical Committee Clearance;

clearance was obtained from ethical committee of the hospital.

Inclusion Criteria

1. Those patients presenting to the hospital within 12 hours of onset of symptoms were taken.
2. Patients were considered to have acute myocardial infarction, only if they had 2 of the following criteria: a) History of chest discomfort b) ECG changes of acute myocardial infarction c) Rise of cardiac enzymes.

Exclusion Criteria:

1. Patients with hypokalemia
2. Patients on diuretics
3. Patients with alcoholic cirrhosis and diarrhea
4. Patients who were treated elsewhere

5. Patients with history of abnormal renal function
6. Patients on magnesium compounds.

All patients will be subjected to a detailed history (including risk factors and MI symptoms) 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. Time of presentation and type of MI was recorded. Serum magnesium levels were estimated in all patients on day of admission. All patients were managed and followed up till discharge/ or death with standard hospital protocol. Occurrence of any type of arrhythmias in the study cases was noted and comparisons were made among cases with and without arrhythmias. Method of Serum Magnesium Estimation Method: Colorimetric end point test Reagent: Xylidyl blue reagent Magnesium standard: 2.5 mg/dL. Reference range for magnesium: Serum magnesium: 1.6 – 2.4 mg/dl. Statistical Analysis The quantitative data was represented as their mean $\pm$ SD. Categorical and nominal data was expressed in percentage. The t-test was used for analysing quantitative data, or else non-parametric data was analyzed by Mann Whitney test and categorical data was analyzed by using chi-square test. The significance threshold of p-value was set at <0.05 . all analysis carried out by using SPSS software version 21.

DISCUSSION

In this study group of 70 cases, 54 were males and 16 were female patients with a male-female ratio of 3.33:1. The maximum Incidence of acute myocardial infarction was seen in the 4th and 5th decades, followed by 6th and 7th decades. 64.29% patients were in the age group of 4th and 5th decade, 24.28% were in the age group of 60-70. In a study by Siddiqui et al. [7], mean age of presentation was 56.6 years ($SD \pm 11.48$) with 88.5% males to 11.5% females. Male to female ratio was 8:1 (885 males & 115 females). Smoking is the most common risk factor found in the patients with acute myocardial infarction (57.2%). Akila A et al. [10] in their study observed smoking as a risk factor in 70% of acute MI cases.. In the present study, out of 70 patients, 25 (35.75%) patients were found to be hypertensive while 17 (24.31%) were obese while 23 (32.89%) patients were found to be diabetics and 15 (21.45%) patients were found to be dyslipidemic. Madani heart hospital trial [11] of 170 patients had hypertension as the most common risk factor found in 43 % patients followed by diabetes (33%). Senthil KP et al. [8] in their study observed that 40% cases of MI had systemic hypertension, 16% had diabetes mellitus and 12% had family history of sudden cardiac death respectively. In the present study, 40 (57.2%) cases presented to the hospital between 3-6 hours of onset of symptoms and 20 (28.6%) cases presented between 0-3 hours.

Remaining 10 (14.3%) cases presented after 6 hours. Chest pain was the commonest symptom and was present in all of the patients in the present study (100%). In this study chest pain is associated with sweating 30 (42.9%) of patients. Chest pain is associated with breathlessness in 30 (42.9%) of the patients. Palpitation associated with chest pain was present in 15 patient (21.45%). study by Siddiqui et al. [7], chest pain was the most common presentation (100%) followed by sweating and nausea & vomiting. Simialr observations were also made by Senthil KP et al. [8] and Nour MK et al. [9].

In the present study of 70 patients, 30 (42.9%) patients had anterior wall MI, 20 (28.6%) patients had inferior wall MI and 15 (21.4%) patients had anterolateral MI and 5 (7.15%) patients had antero-septal MI.

Table 1. Association of Magnesium levels and development of Arrhythmias

Magnesium Levels	Arrhythmia		Total
	No	Yes	
Hypo	3	14	17
	17.6%	82.4%	100.0%
Normal	32	21	53
	60.4%	39.6%	100.0%
Total	35	35	70
	50.0%	50.0%	100.0%
p- value <0.01			

Table 2. Mean Magnesium levels among cases with and without arrhythmias

Arrhythmia	N	Mean	SD	P-Value
Yes	35	1.75	0.33	<0.01
No	35	2.04	0.52	

Mean Magnesium levels among cases with and without arrhythmias was 1.75 and 2.04 mg/dl. The difference was statistically significant.

Table 3. ROC Curve Analysis for efficacy of Magnesium in predicting development of arrhythmias

Area Under the Curve				
Test Result Variable(s)	Area	SE	p- value	Asymptotic 95% Confidence Interval
				Lower Bound Upper Bound
S. Magnesium	0.646	0.066	0.036	0.516 0.776
Ideal Cut-off		Sensitivity		Specificity
2.0 mg/ dl		71.4%		45.7%
2.2 mg/ dl		88.6%		31.4%
2.4 mg/dl		100.0%		20.0%

ROC Curve analysis showed that S. magnesium levels can significantly predict development of arrhythmias in Acute MI cases (AUC = 0.647; $p < 0.05$). At cut-off of 2.0 mg/dl, we observed optimal sensitivity and specificity of 71.4% and 45.7% respectively.

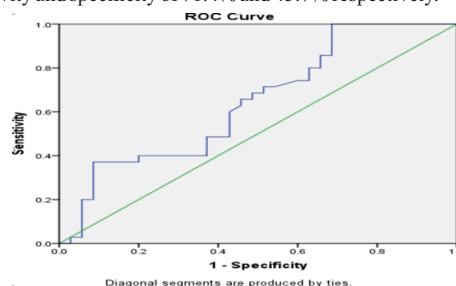


Chart 1; Roc Curve

Table 4. Distribution of cases as per Final Outcome

Mortality	N	%
No	59	84.3%
Yes	11	15.7%
Total	70	100.0%

The mortality rate among cases of acute MI in present study was 15.7%.

CONCLUSION

our results showed a significant difference in the magnesium levels in patients with arrhythmias and without arrhythmias and concluded that in acute myocardial infarction, patients with low magnesium levels are more prone to get arrhythmias.

Magnesium content decreased significantly in infarcted Myocardium. So magnesium treatment can be considered in patients of acute myocardial infarction with low magnesium levels. Our study shown magnesium to be effective in the termination of episodes of arrhythmias. However, further large multi-centric studies are required to validate our study findings.

Conflict of Interest-NIL

Funding-NIL.

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