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PREVALENCE OF SERUM MAGNESIUM LEVELS IN PATIENTS OF ACUTE MYOCARDIAL INFARCTION AND IT'S ASSOCIATION WITH VENTRICULAR ARRHYTHMIA AS A COMPLICATION

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ABSTRACT

Aim and Objective: TO STUDY THE PREVALANCE OF SERUM MAGNESIUM LEVEL IN PATIENTS OF ACUTE MYOCARDIAL INFARCTION AND ITS ASSOCIATION WITH VENTRICULAR ARRHYTHMIA AS A COMPLICATION. **Material Method:** The present prospective observational study was conducted in the department of Medicine at Chattrapati Shivaji Subharti Hospital from 2017 to 2019. -The study group comprised of 50 patients with acute myocardial infarction. Patients were enrolled in the study On the basis of inclusion and exclusion criteria and after obtaining written informed consent from parents and approval from Institutional Ethical Committee. **Results:** Serum magnesium level (mg/dL) i.e. <1.6, 1.7-2.4 and >2.4 was found in 40%, 60% and 0% of the subjects respectively on day 1. Sixteen percent (8) of the subjects with arrhythmia were having serum magnesium level (mg/dL) <1.6 while only 4% of the subjects with arrhythmia reported 1.7-2.4 serum magnesium level (mg/dL). It can be said that patients with acute myocardial infarction with low magnesium level are more prone to develop ventricular arrhythmias compared to those who are having normal magnesium levels. Magnesium replacement therapy in patients with acute myocardial infarction who is having low serum magnesium level may reduce the incidence of arrhythmias. **Conclusion:** Serum magnesium levels on admission were significantly low in patients of arrhythmia as compared with or without arrhythmia. Hypomagnesemia is often associated with arrhythmia. Magnesium therapy reduces the incidence of arrhythmias and mortality even in the absence of demonstrable magnesium deficiency. The present study is a good enough reason to include I.V. magnesium sulfate as an add-on prophylactic treatment in the acute coronary syndrome's management protocol.

KEYWORDS: Hypomagnesemia, magnesium sulphate.

INTRODUCTION

Magnesium: Magnesium is the fourth most common cation in the body, and the second most common intracellular cation after potassium. It is also involved in several processes including: hormone receptor binding; gating of calcium channels; transmembrane ion flux and regulation of adenylate cyclase; muscle contraction; neuronal activity; control of vasomotor tone; cardiac excitability; and neurotransmitter release. In many of its actions it has been likened to a physiological calcium antagonist.[1-3]

Epidemiological studies trace the prevalence of cardiovascular disease and cardiac deaths to the degree of magnesium depletion induced by a diet and drinking water low in magnesium.[4]

Acute myocardial infarction: Coronary heart disease is the most important form of heart disease and single most cause of death. By 2020, it is estimated that it will become the major cause of death in all regions of the world.[5]

Recent investigations have postulated a role for magnesium in many aspects of cardiac disease: control of hypertension, reduction of mortality in myocardial infarction, coronary vasospasm, and sudden death in soft-water areas.[6,7] Although hypomagnesemia has been reported to cause major ventricular arrhythmias even in the absence of cardiac disease, most cases have been associated with toxic reaction to digitalis or acute myocardial infarction. In a study from Sweden, Dyckner[8] showed a 46% incidence of hypomagnesemia in 342 patients with acute myocardial infarction and demonstrated that these patients had a threefold greater frequency of ventricular arrhythmias. Other studies, however, have demonstrated a variable incidence of hypomagnesemia. Abraham et al[9] showed that patients with acute myocardial infarction in Israel had lower serum magnesium levels than controls, but there was no

significant difference in arrhythmia frequency in the patients with lower serum magnesium levels.

In a study from Nebraska, Rector et al[10] showed that serum magnesium levels were decreased in patients whose acute myocardial infarction had been complicated by congestive failure or by ventricular fibrillation. Chadda et al[11] reported decreased serum magnesium levels in patients with acute myocardial infarction in New York City, whereas others in North America have been unable to show any difference in serum magnesium levels between patients with and without acute myocardial infarction. Because these reports differed in study design, sample size, and geographic region, interpretation of their significance is difficult.

Hence it can be said that magnesium ions are considered essential for the maintenance of functional integrity of myocardium. The serum magnesium concentration was found to have great significance in acute MI. So, the present study was undertaken to evaluate the levels of serum magnesium in acute MI.

MATERIAL AND METHOD

The present prospective observational study was conducted in the department of Medicine at Chattrapati Shivaji Subharti Hospital from 2017 to 2019.

The study group comprised of 50 patients with acute myocardial infarction. Patients were enrolled in the study after obtaining written informed consent from parents and approval from Institutional Ethical Committee.

Study duration: 2 years (approximate)
Type of study: Prospective observational study
Study centre: Department of Medicine, Chattrapati Shivaji Subharti Hospital
Sample size: 50

Inclusion criteria

1) Patients who presented to the hospital within 24 hours of onset of symptoms and diagnosed with acute myocardial infarction.

Exclusion criteria

It excludes patients with the following characteristics:

1. Patients having hypokalemia.
2. Patients on medicines which cause alteration in serum magnesium level e.g. Aminoglycosides, Amphotericin B, Cituximab, Cyclosporine, Digoxin, Diuretics (loop, thiazides, osmotic).
3. Patients receiving magnesium containing antacids.
4. Patients with history of chronic alcohol abuse.
5. Patients with malabsorption or chronic diarrhoea.
6. All pregnant women.

Investigation

1. Serum magnesium level
2. Troponin T levels
3. CPK (Mb isoenzyme)
4. Serum sodium and potassium levels
5. Renal function test
6. Echocardiography
7. Serum Lipid profile
8. Twelve lead electro cardio graph

Case selection

The data was collected by a preformed structured interviewer-administered questionnaire that was pretested with modifications made prior to its use in the study. The patients were interviewed that requests for the demographic, socioeconomic status, medical history and previous history of taking any medications and supplements.

Criteria used to diagnose acute myocardial infarction: The following criteria have been used to diagnose acute myocardial infarction. The presence of any of the two criteria has been considered:

1. History of discomfort in the chest.
2. Changes in the ECG suggestive of acute myocardial infarction
3. Rise of cardiac enzymes.

Examination

- Selected patients undergone detailed history and clinical examinations.
- History of chest discomfort/chest pain involving central portion of chest and/or epigastrium described as heaviness, pressure, squeezing, smothering or choking pain. When asked to localize the pain, patient placed a hand over sternum (Levine's Sign).

RESULTS AND CONCLUSION

Serum magnesium level (mg/dL) i.e. <1.6, 1.7-2.4 and >2.4 was found in 40%, 60% and 0% of the subjects respectively on day 1.

Sixteen percent (8) of the subjects with arrhythmia were having serum magnesium level (mg/dL) <1.6 while only 4% of the subjects with arrhythmia reported 1.7-2.4 serum magnesium level (mg/dL).

It can be said that patients with acute myocardial infarction with low magnesium level are more prone to develop ventricular arrhythmias compared to those who are having normal magnesium levels. Magnesium replacement therapy in patients with acute myocardial infarction who is having low serum magnesium level may reduce the incidence of arrhythmias.

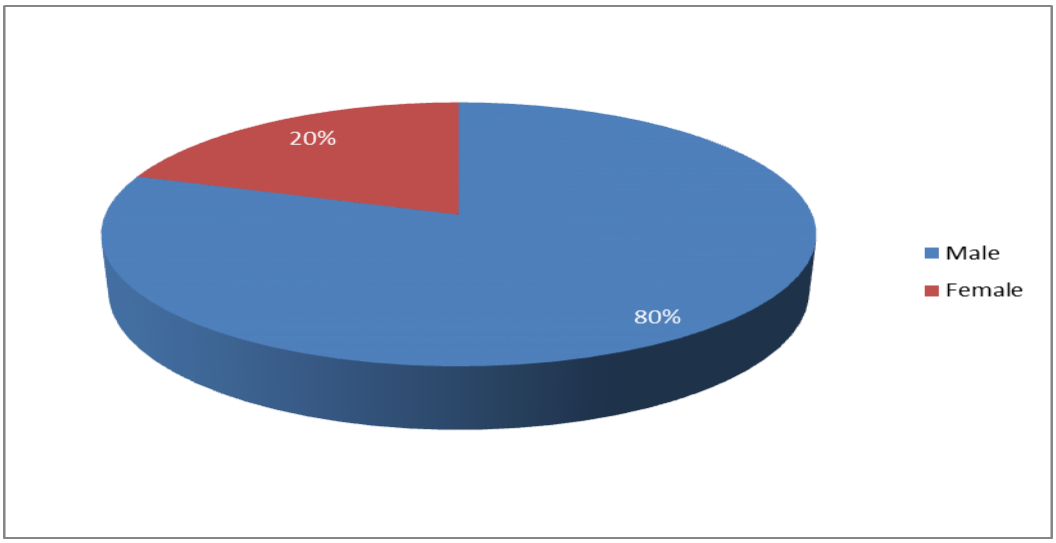
Serum magnesium levels on admission were significantly low in patients of arrhythmia as compared with or without arrhythmia. Hypomagnesemia is often associated with arrhythmia. Magnesium therapy reduces the incidence of arrhythmias and mortality even in the absence of demonstrable magnesium deficiency. The present study is a good enough reason to include I.V. magnesium sulfate as an add-on prophylactic treatment in the acute coronary syndrome's management protocol.

GRAPHS AND TABLES

Table 1: Gender distribution among the study subjects.

Gender	N	%
Male	40	80
Female	10	20
Total	50	100

In the present study, out of the 50 subjects, 80% were males and 20% were females as shown in table 1, graph 1.

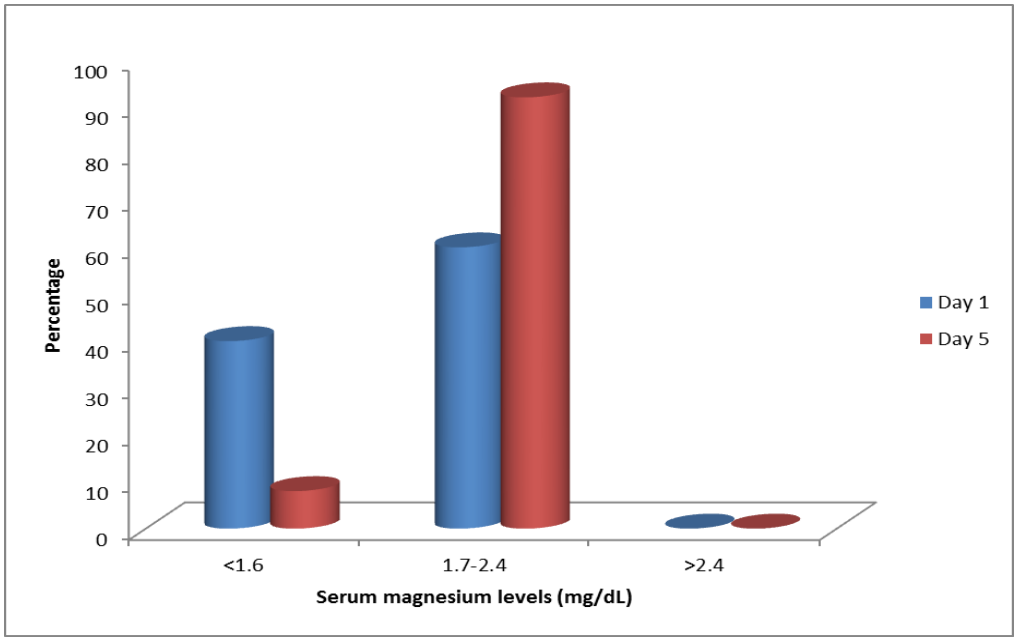


Gender 1: Gender distribution among the study subjects.

Table 2: Serum magnesium levels among the study subjects.

Serum magnesium levels (mg/dL)	Day 1		Day 5	
	N	%	N	%
<1.6	20	40	4	8
1.7-2.4	30	60	46	92
>2.4	0	0	0	0

Serum magnesium level (mg/dL) i.e. <1.6, 1.7-2.4 and >2.4 was found in 40%, 60% and 0% of the subjects respectively on day 1. On day 5, serum magnesium level (mg/dL) <1.6 was reported only in 8% of the subjects while >2.4 level was revealed in 46% of the subjects (table 6, graph 6).



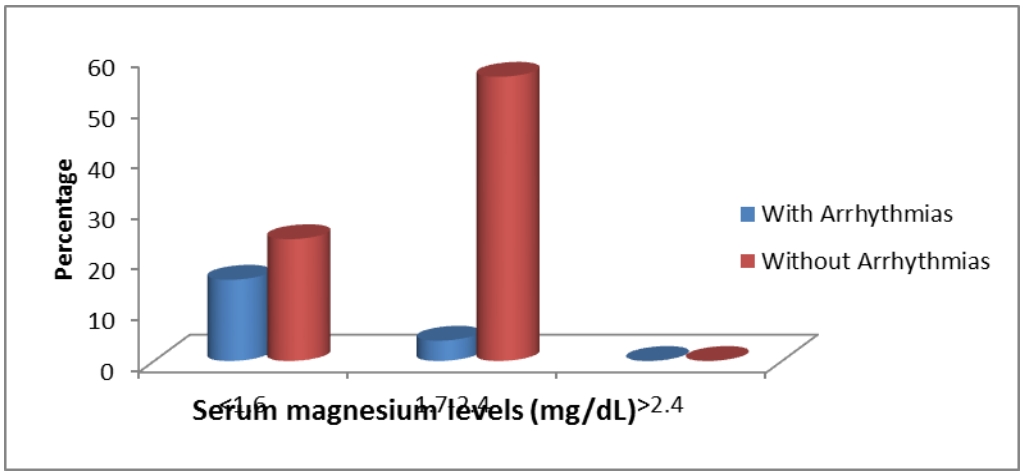
Graph 2: Serum magnesium levels among the study subjects.

Table 3: Serum magnesium levels distribution in relation to with and without arrhythmias at day 1.

Arrhythmias	<1.6		1.7-2.4		>2.4	
	N	%	N	%	N	%
With	8	16	2	4	0	0
Without	12	24	28	56	0	0
Chi square	8.33					
p value	0.004*					

*: statistically significant.

In the present study, arrhythmia was found in 10 (20%) subjects. Sixteen percent (8) of the subjects with arrhythmia were having serum magnesium level (mg/dL) <1.6 while only 4% of the subjects with arrhythmia reported 1.7-2.4 serum magnesium level (mg/dL). Fifty six percent of the subjects without arrhythmia reported 1.7-2.4 serum magnesium level (mg/dL). When subjects with and without arrhythmia were compared according to the serum magnesium level, it was found to be statistically significant as $p<0.05$ as shown in table 7, graph 7. These findings were revealed on day 1.



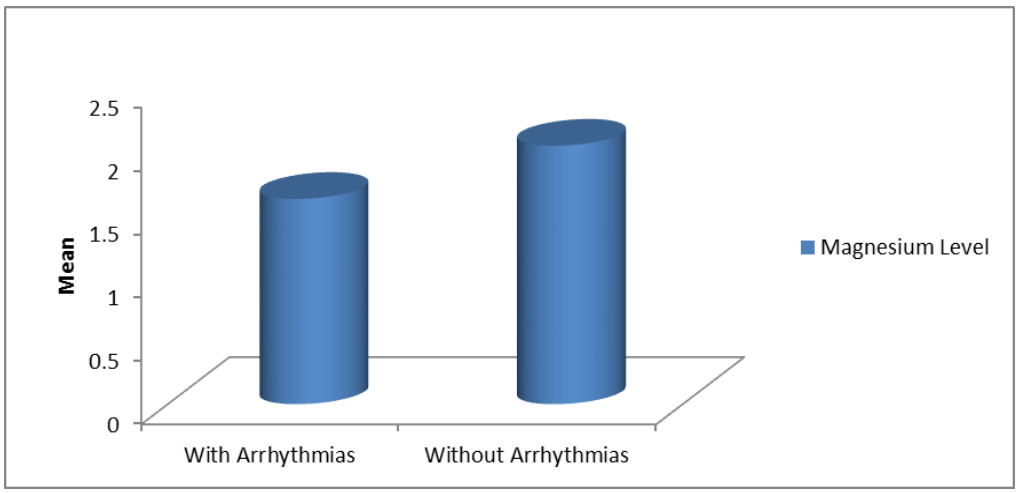
Graph 3: Serum magnesium levels distribution in relation to with and without arrhythmias at day 1.

Table 10: Serum magnesium level among the subjects with and without arrhythmias.

Magnesium level	Arrhythmias at Day 1	
	With	Without
Mean	1.62	2.04
SD	0.36	0.44
t test	2.73	
p value	0.03*	

*: statistically significant.

In the present study groups, the serum magnesium level on day-1 was significantly lower in patients with arrhythmias than those without arrhythmia ($p<0.001$). When mean serum magnesium level was compared statistically among the subjects with and without arrhythmias, it was found to be statistically significant as $p<0.05$ as shown in table 10, graph 10.



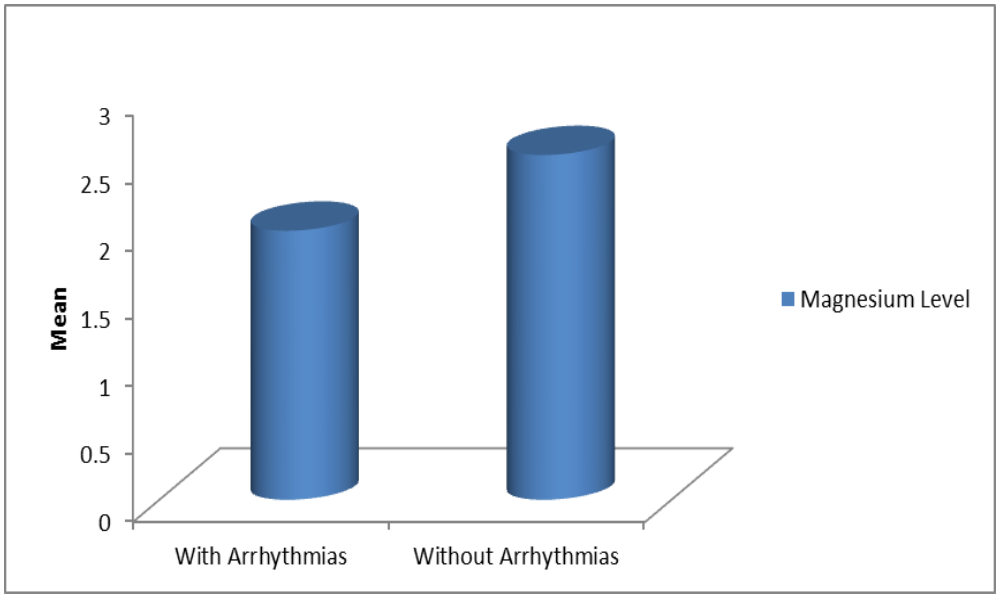
Graph 10: Mean serum magnesium level among the subjects with and without arrhythmias at day 1.

Table 4: Serum magnesium level among the subjects with and without arrhythmias.

Magnesium level	Arrhythmias at Day 5	
	With	Without
Mean	1.99	2.55
SD	0.40	0.46
t test	2.99	
p value	0.02*	

*: statistically significant.

In the present study groups, the serum magnesium level on day-5 was significantly lower in patients with arrhythmias (1.99) than those without arrhythmia (2.55). When mean serum magnesium level was compared statistically among the subjects with and without arrhythmias, it was found to be statistically significant as $p<0.05$ as shown in table 11, graph 11.



Graph 4: Serum magnesium level among the subjects with and without arrhythmias at day 5.

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