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Original Research Paper

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A CASE CONTROL STUDY ON SERUM MAGNESIUM LEVELS IN ACUTE MYOCARDIAL INFARCTION

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ABSTRACT

Introduction: Magnesium has been linked to the development of arrhythmia, a consequence of myocardial infarction, as well as the disease itself. Magnesium enhances myocardial metabolism and prevents calcium build-up, myocardial cell death, and myocardial cell death. It enhances lipid metabolism, peripheral vascular resistance, cardiac output, afterload, and vascular tone. It also lowers cardiac arrhythmias. Magnesium also enhances endothelial function, lessens sensitivity to oxygen-derived free radicals, and prevents platelet adhesion and aggregation. **Objective:** To compare serum magnesium levels in patients with acute myocardial infarction and non-MI patients. **Materials and Methods:** 30 patients with acute myocardial infarction and 30 healthy controls of similar age and sex were enrolled in this case-control study. By using the colorimetric xylidyl blue complex technique, serum magnesium is determined. Statistical analysis carried out using statistical software SPSS version 16 and p-value < 0.05 considered statistically significant. **Results:** We found that the mean serum magnesium levels in cases was 1.03 ± 0.89 mg/dl and among controls was 2.24 ± 0.31 mg/dl which was much higher and this difference was statistically significant ($p<0.05$).We found that 36.7% of cases had hypomagnesaemia while none of controls had it, ($p<0.001$). **Conclusion:** Patients with low magnesium levels are more likely to experience arrhythmias after acute myocardial infarction. Hence, patients with acute myocardial infarction and low magnesium levels may benefit from magnesium therapy.

KEYWORDS : Magnesium, Hypomagnesemia, Myocardial Infarction

INTRODUCTION

The most significant result of coronary artery disease is acute myocardial infarction, which can result in consequences such as ventricular arrhythmia and congestive heart failure. Hypertension, dyslipidemia, diabetes, smoking, alcoholism, obesity, stress, advanced age, and lack of exercise are some of the main risk factors for AMI.[1]

Magnesium is a mineral that is essential to many metabolic processes that take place inside the human body. It is a crucial cofactor in all enzymatic operations that depend on ATP. Magnesium safeguards the heart by lowering ATP consumption and contractility.[2] Magnesium blocks potassium efflux and calcium influx, two processes that are detrimental to the survival of heart muscle during ischaemia.[3] According to a study, low magnesium level is a significant risk factor for the development of atherosclerosis.[4] According to a study by Flink E. et al., within the first 48 hours after an AMI, levels of free fatty acids rise while levels of magnesium fall.[5] This happens as a result of an abrupt rise in catecholamine levels during an AMI, which causes lipolysis to lower the amount of magnesium via increased absorption of magnesium into adipocytes and intracellular saponification by free fatty acids.[6] Another issue, such as diarrhoea, drinking, stress, and excessive use of diuretics, might result in hypomagnesemia.[7]

The importance of magnesium in ventricular fibrillation, which results in sudden mortality in IHD, has been noted.[8] Another significant contributing cause to the sudden death of IHD has been identified as coronary vasospasm due to magnesium shortage. It has also been suggested that a lack of magnesium contributes to the development of atheromatous plaques, which results in hyperlipidemia. The prognosis for myocardial infarction, one of the most prevalent causes of death today, relies on a number of variables, many of which are still unknown. This investigation aims to determine the association between acute myocardial infarction patients' serum magnesium levels and arrhythmias.[9]

It was discovered that the myocardial magnesium concentration was extremely low in patients who had died suddenly from ischemic heart disease. The importance of magnesium in ventricular fibrillation, which results in sudden mortality in IHD, has been noted. The prognosis for myocardial infarction, one of the most common causes of death today, relies on a number of variables, many of which are still unknown. Serum magnesium levels and arrhythmias in individuals with acute myocardial infarction and non-MI patients were compared in this case control research.

METHODOLOGY

After receiving approval from the institutional ethical committee, a case-control study was conducted by the Department of General Medicine of a tertiary care centre in North Karnataka

Sample size estimation was done using Open EPi Software Version 2.3.1. At 95% confidence level and 80% power of the study, based on previous study, Lal et.al.[10], Mean ± SD of serum magnesium in patients with arrhythmia was 1.65 ± 0.26 and in patients without arrhythmia was 2.08 ± 0.41. Sample size is calculated using the formula, $n=2(Z\alpha+Z1\text{-}\beta)2\sigma^2/d^2$ The estimated sample size was 26 which was inflated to 30. We considered 30 cases and 30 controls for this study.

According to WHO criteria, including the typical history, typical ECG alterations of acute myocardial infarction, and increased cardiac enzymes, the study was done among 30 instances of acute myocardial infarction for 6 months. We excluded patients with patients with hypokalemia and patients on diuretics,

Following the selection of patients, a pertinent physical examination and history was conducted. Investigations include a complete blood count, urine test, blood sugar, blood urea, serum creatinine, fasting lipid profile, cardiac enzymes, and an ECG were performed on the patients. Estimation of serum magnesium level was done within the first 24 hours of chest pain.

All data was entered in Microsoft excel and statistical analysis was performed using the statistical software SPSS version 21.0. Continuous variables are presented as mean and standard deviation and were compared using the independent sample t- test. Categorical variables were expressed as frequencies and percentages and compared using the Chi-square test.

RESULTS

We studied a total of 30 cases of MI and 30 controls. Table 1 shows baseline characteristics of our study groups. Controls were age and gender matched. Table 1 shows the baseline characteristics of cases and controls in our study. We found that smoking, family H/O of CAD and hypertension was found more frequently among cases compared to control and this was statistically significant ($p<0.05$)

Table 1: Baseline Characteristics

Variables		Cases	Controls	P value
Age	30-40 years	2 (6.7%)	3 (10%)	0.925
	41-50 years	8 (26.7%)	7 (23.3%)	
	51-60 years	16 (53.3%)	14 (46.7%)	
	61-70 years	3 (10%)	5 (16.7%)	
	>71 years	1 (3.3%)	1 (3.3%)	
Gender	Males	21 (70%)	20 (66.7%)	0.78
	Females	9 (30%)	10 (33.3%)	
Occupation	Farmer	11 (36.7%)	12 (40%)	0.79
	Business	7 (23.3%)	4 (13.3%)	
	Service	4 (13.3%)	5 (16.7%)	
	Unemployed	8 (26.7%)	9 (30%)	
Risk factors	Smoking	21 (70%)	11 (36.7%)	0.009
	Family H/O CAD	6 (20%)	1 (3.3%)	0.044
	Obesity	7 (23.3%)	2 (6.7%)	0.071
	Hypertension	9 (30%)	2 (6.7%)	0.019
	Diabetes	12 (40%)	7 (23.3%)	0.165
	Dyslipidemia	4 (13.3%)	2 (6.7%)	0.389

Table 2 shows that characteristics of MI among our cases. We had majority presented within 6 hours of chest pain (56.7%) which was most common symptom in our cases (100%). Anterior wall MI was the commonest type of MI in our study (43.3%)

Table 2: Comparison Of Outcome Variables Among Study Groups

		Frequency	Percentage
Time at presentation	< 6 hours	17	56.7%
	> 6 hours	13	43.3%
Symptoms	Chest pain	30	100%
	Sweating	18	60%
	Breathlessness	20	66.7%
	Palpitation	15	50%
Type of MI	Anterior wall MI	13	43.3%
	Inferior wall MI	10	30.3%
	Anteroseptal MI	5	16.7%
	Anterolateral MI	2	6.7%

We found that the mean serum magnesium levels in cases was 1.03 ± 0.89 mg/dl and among controls was 2.24 ± 0.31 mg/dl which was much higher and this difference was statistically significant when independent sample t-test was applied (p-0.0001)[Figure 1]

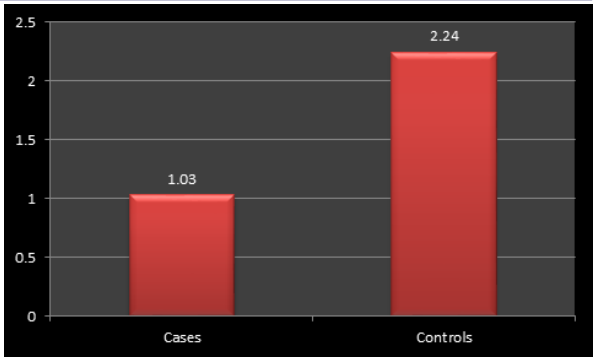

Figure 1: Bar Graph Showing Mean Serum Magnesium Among Cases And Controls

Table 3 shows that there was a statistically significant difference in serum magnesium levels. We found that 36.7% of cases had hypomagnesaemia while none of controls had it., ($p<0.001$).

Table 3: Comparison Of Magnesium Levels Among Study Groups

Serum magnesium	Cases	Controls	P value
Normal	19 (63.3%)	30 (100%)	<0.001
Hypomagnesaemia	11 (36.7%)	0	

DISCUSSION

Recently, the magnesium ion has been thought of as a primary cardiovascular cation. It plays a variety of vitally important tasks in keeping the body's proper homeostasis. In maintaining cardiac homeostasis, it is crucial. Magnesium is crucial for ATP activation, which is required to keep the sodium-potassium pump functioning. Patients with acute myocardial infarction have arrhythmias that have been linked to magnesium shortage.

We found that 36.7% of cases had hypomagnesaemia while none of controls had it. ($p<0.001$).Our findings were comparable to other studies in table 4.

Table 4: Comparison Of Hypomagnesaemia In MI Cases With Other Studies

Studies	Hypomagnesimia % among cases
Our study	36.7%
Sreenivas et.al.11	32%
Madis et.al.12	25.9%
Dyekner et.al.13	46%
Ryzen et.al.14	7.7%

We found that the mean serum magnesium levels in cases was 1.03 ± 0.89 mg/dl and among controls was 2.24 ± 0.31 mg/dl which was much higher and this difference was statistically significant when independent sample t-test was applied (p-0.0001)Table 5 shows comparison of our findings with others.

Table 5: Comparison Of Mean Serum Magnesium In Cases And Controls With Other Studies

Studies	Serum Magnesium (Mean ±SD)	
	Cases	Controls
Our study	1.03 ± 0.89	2.24 ± 0.31
Sreenivas et.al.11	1.22 ±0.29	2.1 ±0.13
Govindmohan et.al.15	1.41±0.13	2.51±0.16
Chakraborty et.al.16	1.7±0.17	2.16±0.25
Baset A et.al.17	1.86±0.39	2.26±0.50
Lal L et.al.10	1.01±0.94	2.2±2.23
Vedamanickam R et.al.18	1.23±0.98	2.12±0.68

CONCLUSION

Serum magnesium was significant lower in cases with MI compared to those without MI. With validation through studies with a larger sample size, prophylactic intravenous

magnesium sulphate administration may be considered in all cases of acute myocardial infarction as an adjuvant to thrombolytic therapy and in patients not suitable for thrombolysis to prevent cardiac arrhythmias and reduce short-term mortality.

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