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STUDY THE IN HOSPITAL MORTALITY AND MORBIDITY IN PATIENTS OF ACUTE MYOCARDIAL INFARCTION WITH RESPECT TO SERUM MAGNESIUM LEVELS

General Medicine

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ABSTRACT

Magnesium improves myocardial metabolism, reduces platelet aggregation, decreases systemic vascular resistance, dilates coronary arteries, guards against catecholamine induced myocardial necrosis, and stabilizes cell membranes. Ventricular tachyarrhythmia, sudden cardiac death and re-infarction are frequently results of hypomagnesaemia in the early post-acute myocardial infarction (AMI) period. In this prospective observational study, all patients presenting in the emergency with Acute onset anginal chest pain and associated symptoms were screened for AMI by obtaining an Electrocardiogram and Biochemical Markers. For those diagnosed to have ST elevation myocardial Infarction were subjected to detailed clinical history and examination. Serum Magnesium levels and Electrolyte would be obtained within 6 hours of the admission. Patients were treated as per the standard line of management on the advice of the treating physician/ cardiologist. **Summary:** In the present study there is significant association seen between serum magnesium level and arrhythmia, morbidity of the study subjects, need of ventilator support, mortality, history of alcoholics, serum potassium level and serum troponin. I level in the study subjects. On the basis of present study, it is concluded that Magnesium plays a cardinal role in management and prevention of complications related to cardio-vascular event and its estimation in acute myocardial infarction serves as a tool for assessment of severity of the disease and envisage possible adverse outcomes including prevention of morbidities and mortality associated with hypomagnesemia in acute myocardial infarction patients

KEYWORDS

Serum Magnesium, Myocardial Infarction, Arrhythmia, Mortality

INTRODUCTION

Acute myocardial infarction (AMI) is defined as a clinical or pathological event in setting of ischemia, where there is evidence of myocardial damage, in presence of clinical symptoms, electro cardiographic changes or imaging suggestive of new loss of heart muscle or new onset regional wall abnormality, characterized by elevated cardiac biomarkers in blood.

Among the various complications of AMI, arrhythmias are one of the most common complication which is responsible significantly for morbidity and mortality. various factors like electrolyte imbalance including hypomagnesemia, hypokalemia have been implicated as causative factor for arrhythmias.

Hypokalemia and hypomagnesemia can occur in heart failure (HF) patients for a variety of reasons, including undernutrition, hyperactivity of the renin-angiotensin system (RAS), medication treatment (loop and thiazide diuretics), and others. It is common knowledge that these disorders raise the risk of sudden death and arrhythmia. The serum magnesium (sMg) concentration levels of HF patients should be assessed since hypomagnesemia can worsen arrhythmia and create refractory hypokalemia when diuretics are used to treat HF. According to studies, hypomagnesemia is a standalone risk factor for cardiovascular disease, and replacement treatment is thought to be required for long-term prognosis[1-3]

Magnesium is a key regulator of vascular tone, atherogenesis, thrombosis, vascular calcification, vascular smooth muscle cell proliferation and migration, and other processes.

Magnesium improves myocardial metabolism, reduces platelet aggregation, decreases systemic vascular resistance, dilates coronary arteries, guards against catecholamine-induced myocardial necrosis, and stabilizes cell membranes[4]

Ventricular tachyarrhythmia, sudden cardiac death, and re-infarction are frequently results, hypomagnesaemia in the early post-AMI period is extremely important. Since the early 1960s, magnesium has been mentioned as a potential remedy for AMI, mostly because it was assumed to be an antiarrhythmic agent. However, no research have clearly demonstrated that this is how magnesium works to reduce mortality[5]

Magnesium, as a physiologic calcium antagonist and a divalent cation, prevents calcium from entering vascular smooth muscle cells. Additionally, magnesium encourages peripheral and systemic arterial vasodilation, which increases coronary blood flow and lowers afterload. Magnesium may lessen sinus node and atrioventricular conduction, as well as ischemia. Magnesium may lessen infarct associated reperfusion damage and myocardial shock, hence minimizing infarct size, by preventing sodium, calcium, and potassium input into myocardial cells[6,7]

Magnesium has demonstrated to be beneficial in the development and management of supraventricular arrhythmias. The likelihood that atrial fibrillation will turn into sinus rhythm has risen with the use of magnesium supplements. Magnesium, although beneficial in management of arrhythmias, was shown to be less effective than Amiodarone in treating acute atrial tachyarrhythmias. According to a theory, magnesium prevents arrhythmias by obstructing slow calcium channels and decreasing sodium potassium ATPase activity[8]

Fig 1: ECG changes in hypomagnesemia

METHODOLOGY

All patients presenting in the emergency with Acute onset anginal chest pain were screened for Acute myocardial Infarction by obtaining an Electrocardiogram and Biochemical Markers. For those diagnosed to have ST elevated myocardial Infarction were subjected to detailed clinical history and examination. Serum Magnesium levels, Electrolyte and Serum Creatinine were obtained within 6 hours of the admission. Patients were treated as per the standard line of management as per the advice of the treating physician/ cardiologist. During the hospital stay patients were monitored for development of complication especially arrythmia. For this, patients were monitored on the bedside monitors and a standard 12 lead ECG were obtained as and when required. The primary endpoint was all cause mortality during the hospital stay and duration of ICU and hospital stay were used as secondary endpoints for morbidity.

Data Variables collected:

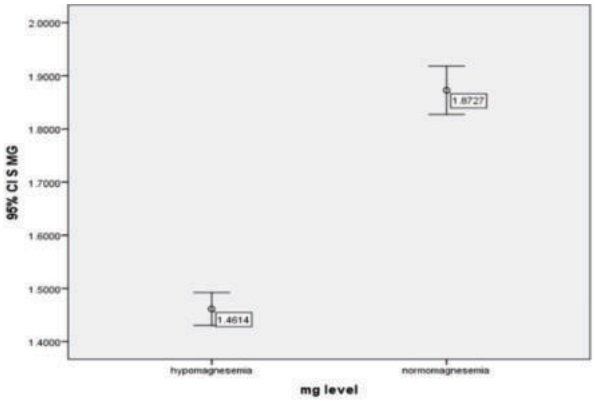
1) Socio-demographic data
2) Presenting Symptoms
3) Risk Factors Include: Systemic Hypertension, Obesity, Smoking, Dyslipidaemia, Alcoholism, Family history of Hypertension, Diabetes, Ischemic heart disease, Cerebrovascular disease etc.
4) Type of Myocardial Infarction Categorized by area of involvement on ECG
5) Type of Arrhythmias Categorized during hospital stay
6) Levels of Serum Magnesium (mg/L)

<1.7 (Hypomagnesemia)
1.7 to 2.4 (Normal Magnesium Levels)
>2.4 (Hypermagnesemia)

RESULTS

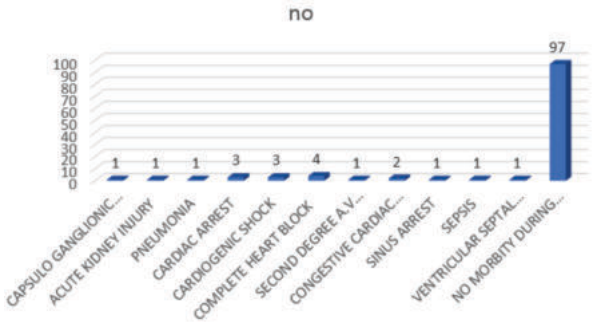
The study is an observational prospective study consisting of 115 patients with acute myocardial infarction with typical symptoms of AMI with or without significant elevation of cardiac biomarkers, various parameters were noted and correlated with their serum magnesium levels. It was observed that: - Demographically, 32.2% study subjects were in an age group of 50-59 years, 28.7% study subjects were in the age range 60-69 years,18.3% of age group 70-79 years,13.9% of age group 40-49, only 5.2% study subjects had age group 30-39 years and 1.7% study subjects had age group 80-89 years. 68.7% of the study participants were men, and the remaining 31.3% were women.

- The mean serum magnesium level in hypomagnesemia group was 1.46±0.12, whereas in normomagnesemia group it was 1.87±0.17.



Graph 1: Distribution of study subjects as per serum Magnesium

- 39.1% of study participants had serum potassium levels between 3 and 4, 54.8% had levels above 4, and only 6.1% had serum potassium levels below 3. The average level of serum potassium was 4.08.
- 84.3% study subjects had Troponin I level 5-7, 11.3% study subjects had Trop I level >7 whereas 4.3% subjects had Troponin I level <5.
- 26.1% study subjects had history of Diabetes mellitus
- 33.9% study subjects had history of Hypertension
- 6.96% i.e., 8 study subjects were post PTCA (percutaneous transluminal coronary angioplasty), 0.9% have known history of coronary artery disease (unspecified), history of old myocardial infarction and unstable angina respectively in past i.e., 1 study subject each, whereas 1 subject was post CABG (coronary artery bypass graft)
- 3.5% study subjects had history of alcoholism.
- 40.9% study subjects had lesion at anterior wall, 32.2% study subjects had lesion at inferior wall, 9.6% study subjects had lateral wall lesion, 5.2% study subjects had septal lesion, 3.5% subjects had anteroseptal and inferolateral respectively, 2.6% patients had antero-lateral and extensive anterior wall lesions respectively.
- 4.3% study subjects had VT (Ventricular Tachycardia), whereas 3.5 % had AF (Atrial Fibrillation), 0.9% had VF (Ventricular Fibrillation) and PSVT (Paroxysmal Supraventricular tachycardia) respectively
- During hospital stay, 3.4 % developed complete heart block, 2.6% had cardiac arrest and cardiogenic shock respectively, 1.7% study subjects had congestive cardiac failure. 0.9% study subjects (i.e., 1 individual each) had, second degree AV (Atrioventricular) block, sinus arrest, sepsis, ventricular septal rupture, acute kidney injury, pneumonia and capsule-ganglionic bleed.



Graph 2 : Distribution of different type of Morbidity in the study subjects

- 4.3% mortality was also found in the present study i.e., 5 deaths occurred in total out of which 2 deaths occurred due to cardiogenic shock, 1 occurred due to ventricular tachycardia, 1 due to ventricular fibrillation and 1 occurred due to MODS (multiple organ dysfunction syndrome) in a patient of acute pancreatitis.
- 4.3% subjects i.e., 5 patients need ventilatory support in the current study.
- 80% study subjects had CCU (critical care unit) stay 1-5 day, 13.9% subjects had CCU stay between 6-10 day, 3.5% study subjects had CCU stay 11-15 day.
- In our present study there is non-significant association of serum magnesium with age, sex, area of involvement (area of infarction in ECG), of the study subjects
- There is significant association of serum magnesium level with occurrence of arrhythmia, morbidity of the study subjects, need of ventilator support and in hospital mortality.
- Serum potassium level and Troponin. I level had significant association with serum magnesium level in the study subject.

CONCLUSION

The current study concludes that: -

Hypomagnesemia is a common electrolyte imbalance in the critically ill patients. It is associated with higher mortality and morbidity rate.

Also, hypomagnesemia is associated with increased length of stay and need for ventilatory support.

Magnesium plays a cardinal role in management and prevention of complications related to cardiovascular event and its estimation in acute myocardial infarction serves as a tool for assessment of severity of the disease and envisage possible adverse outcomes including prevention of in hospital morbidities and mortality associated with hypomagnesemia in acute myocardial infarction patients

On the basis of present study, we can conclude that there is significant association of serum magnesium level with arrhythmia, morbidity of the study subjects, need of ventilator support, and also mortality in the study subjects.

Association of serum magnesium with hypokalemia and elevation of cardiac biomarkers and alcoholism is also noted.

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