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Prevalence of ACS and Causal Relation of Hypomagnesaemia

Bina Nasim[1], Ahmed Sajjad[1], Zafar Khan[1], Zulfiqar Ali[1], Anis Sheikh[1], Tanvir Yadgir[1], Wajahat Khan[1], Omer Sakaf[1] and Ghulam Yasin Naroo[1*]

[1]Emergency Medicine, Rashid Hospital, Dubai, United Arab Emirates.

Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Magnesium is an important intracellular cation [1], actually the second most abundant cation after Potassium, which has gained an essential role in normal human homeostasis. Low serum magnesium has been detected commonly in around 12% hospitalized patients and even more commonly in Intensive Care Patients as high as 60 to 65%.

The link of low serum magnesium with acute coronary syndrome is being discussed widely and its actual role is being scrutinized [2,3].

Recently, Hypomagnesaemia has also been found to play an important role in the pathogenesis of a variety of clinical disorders including Hypertension, Diabetes Mellitus, Atherosclerosis and Acute Coronary Syndromes [4-8].

Acute coronary syndrome (ACS) has been defined as a group of conditions due to decreased blood flow in the coronary arteries. Acute coronary syndrome includes a vast spectrum like: ST elevation myocardial infarction (STEMI / 30%), non ST elevation myocardial infarction (NSTEMI / 25%), or unstable angina (U.A. / 38%).These are described according to ECGs and Cardiac Biomarkers of myocardial necrosis (troponin T, troponin I, and CK MB), in patients presenting with acute cardiac chest pain (Medscape).

**Corresponding author: E-mail: gynaroo@dha.gov.ae;*

Aim: To look for any association between Hypomagnesaemia and Acute Coronary Syndrome.
Materials and Methods: It's a retrospective study involving 1198 patients who presented to the Accident and Emergency department (A & E), Trauma Center, Rashid Hospital, Dubai, with Acute Coronary Syndrome (ACS) between April 2010 and May 2013.
We reviewed the records of all patients including their clinical history and presentation.
The Magnesium levels of all the patients in the ACS pathway were checked along with, Cardiac biomarkers - Troponin, CPK and CK MB and Lipid profiles were also analyzed.
A Chi-Square test was performed at 5% level of significance to test the null hypothesis of no association between cardiac markers, lipid profile and magnesium level.
Inclusion Criteria: All new patients presenting to A & E Department at Rashid Hospital with an acute coronary syndrome (both NSTEMI & STEMI).
All new patients presenting with non-specific chest pain who test positive for cardiac markers.
All the age groups presenting to A & E Department at Rashid Hospital from 11/04/2010- 30/05/2013 were included. Both the genders were included.
Exclusion Criteria: Patients diagnosed initially with acute coronary syndrome that eventually had negative cardiac markers.
Results: Out of 1198, 1087(91%) patients were male. 49% were between 50 and 75 years of age group whereas 46% were between 25 years and 50 years of age. 77% patients were Asians and 17% belonged to Arabic peninsula. The Magnesium level was normal in 1097(92%), low in 63(5.3%). Troponin was negative in 431(36%) and positive in 767(64%) patients with low, medium and high levels in 338(28.2%), 426(35.5%) and 03(0.3%) respectively.
These results indicate that there is no statistically significant association between Magnesium levels and Troponin groups (positive and negative) (chi-square with two degree of freedom = 3.30, $p = 0.192$).
Conclusion: Our study proves that there is no significant association between Hypomagnesaemia and Acute Coronary Syndrome.

Keywords: Acute Coronary Syndrome (ACS); ST Elevation Myocardial Infarction (STEMI); Non ST Elevation Myocardial Infarction (NSTEMI); Unstable Angina (U.A); Atherosclerosis in Risk Community Study (ARIC); The National Health and Nutritional Examination Survey (NHANES); The Second Leicester Intravenous Magnesium Intervention Trial (LIMIT-2); Dubai Health Authority (DHA).

1. INTRODUCTION

Magnesium along with Potassium is the second most abundant intracellular cation and 4th most abundant cation in the human body. The total magnesium content in the body of an average adult is around 25 Gm or 1000 mmol. About 60% of the body reserve of magnesium is found in the skeletal bone mass, about 20% is in muscle and another 20% is in soft tissues and liver. Normal plasma Magnesium concentration is from 1.7 to 2.5 mg/dl, with about 1/3rd bound to protein (33%) and 2/3rd existing as free cation. (12% complexed with Anions & 55% in free ionized form).

Magnesium homeostasis is controlled by absorption that takes place in the upper small intestine, where nearly 30 to 50% of consumed magnesium is taken up depending upon the endogenous magnesium status. The excretion of magnesium is mainly by the kidneys. Nutritional sources include green vegetables, cereal, grain, nuts, legumes, and chocolate. Vegetables, fruits, meats, and fish have intermediate values.

The pathogenesis of hypertension and diabetes has been linked to low serum magnesium [4-6]. Recent studies have shown that serum magnesium is inversely related to hospitalizations and mortality in patients with coronary heart disease [9].

According to American heart association (AHA), serum magnesium level must be >2.0 mg/dl in patients with acute myocardial infarction as normal magnesium levels are thought to protect the myocardium from reperfusion injury.

Supplementation of magnesium is thought to improve endothelial function, inhibits the function of platelets, causes dilatation of the coronaries, reduces the afterload and also suppresses the release of catecholamines, which prevents the extension of an infarct.

1.1 Aims and Objectives

To assess the relationship between low serum magnesium and Acute Coronary Syndrome.

2. MATERIALS AND METHODS

It's a retrospective study involving 1198 patients who presented to the A & E Department, Trauma Center, Rashid Hospital, Dubai, with Acute Coronary Syndrome (ACS) between April 2010 and May 2013.

We reviewed the records of all patients including their clinical history and presentation. The Magnesium levels of all the patients in the ACS pathway were checked along with, Cardiac biomarkers - Troponin, CPK and CK MB and Lipid profiles were also analyzed. The results were recorded in a chart to determine a correlation between patients who have hypomagnesaemia and acute coronary syndrome.

A Chi-Square test was performed at 5% level of significance to test the null hypothesis of no association between cardiac markers, lipid profile and magnesium level.

2.1 Normal Reference Ranges

Magnesium- 1.7-2.5 meq/L. Low-<1.7 meq/L, high->2.5 meq/L.

Troponin-Negative-<0.01 ng/ml, Positive-<0.10 ng/ml-low risk, >0.1 ng/ml- medium or high risk.

CPK- 0-167 iu/L, high- >167 iu/L. CKMB- 0-24 iu/L, high- >24 iu/L.

Cholesterol- 50-200 mg/dl, high->200 mg/dl.

2.1.1 Inclusion criteria

All new patients presenting to A & E Department at Rashid Hospital with an acute coronary syndrome (both NSTEMI & STEMI).

All new patients presenting with non-specific chest pain who test positive for cardiac markers.

All the age groups presenting to A & E Department at Rashid Hospital from 11/04/2010-30/05/2013.

Both the genders were included.

2.1.2 Exclusion criteria

Patients diagnosed initially with acute coronary syndrome that eventually had negative cardiac markers.

3. RESULTS

A total of 1198 patients' data with Acute Coronary Syndrome was analyzed. 1087(90.7%) were male and 111(9.3%) female. 1141(95.3%) patients were between 25 to 75 years of age whereas 49(4.1%) belonged to more than 75 years. 08(0.7%) patients were below 25 years. 1135(94.8%) belonged to Asia including Arab peninsula. Rest was from Europe (2.8%) and other regions (2.4%). Cholesterol level was normal in 618(51.6%) and high in 580(48.4%) patients. CKMB level was high in 570(47.6%) and normal in 628(52.4%) patients. The Magnesium level was normal in 1097(92%), low in 63(5.3%) and high in 38(3.2%) patients. Troponin was negative in 431(36%) and positive in 767(64%) patients with low, medium and high levels in 338(28.2%), 426(35.5%) and 03(0.3%) respectively.

These results indicate that there is no statistically significant association between Magnesium levels and Troponin groups (positive and negative) (chi-square with two degree of freedom = 3.30, $p = 0.192$).

There is no statistically significant association between CKMB levels and Magnesium levels (chi-square with two degree of freedom = 0.93, $p = 0.628$).

There is no statistically significant association between Cholesterol levels and Magnesium levels (chi-square with two degree of freedom = 4.26, $p = 0.119$).

4. DISCUSSION

Low serum magnesium has long been considered as a risk factor for cardiac arrhythmias but its association has been shown now with coronary heart disease also. Evidence from The Atherosclerosis in Risks communities study (ARIC) [2,6], involving over 15,000 patients over seven year period showed inverse relationship between low magnesium and carotid wall thickness. It also linked low serum magnesium to hypertension, diabetes and cardiovascular disease.

The National health and Nutritional Examination Survey (NHANES I) [10], follow up study also showed inverse relationship between Serum Magnesium and the hospitalization and mortality in patients with Coronary Heart Disease. It showed the link of certain dietary risk factors which are modifiable like dietary magnesium, alcohol, smoking, lifestyle and exercise, diuretic use and certain individual characteristics like race and lipid profile with coronary heart disease.

An important effect of Magnesium is the inhibition of the production of catecholamine from the adrenal medulla, thereby suppressing their arrythmogenic effect and also inhibiting their vasoconstrictor effect which reduces the incidence of Unstable Angina and Acute Myocardial infarction (AMI).

The Second Leicester Intravenous Magnesium Intervention Trial (LIMIT-2) [11], study, which was a double blind randomized trial of over 2000 patients, incorporated patients with suspected Acute Myocardial Infarction who were given either iv Magnesium or placebo prior to receiving reperfusion therapy (thrombolysis). And it showed a reduction in the mortality of elderly patients and lower incidence of ventricular arrhythmias.

But the results of the Fourth International Study of Infarct Survival (ISIS-4) [12], in contrary to the above studies showed that the 24 hour intravenous infusion of Serum Magnesium in patients with Acute Myocardial Infarction given after thrombolytic agent was administered did not have any positive effect on the hospitalization or the mortality of the AMI patients.

5. CONCLUSION

The conclusion of our study is that low serum magnesium is not a risk factor for acute coronary syndrome, as there is no statistical significant relationship between low serum magnesium and the occurrence of acute coronary syndrome. Our study also shows that there is no statistical relationship between hypomagnesemia and high blood cholesterol levels.

CONSENT

Patient's record is accessible by authorized personals only however consent of patients is not applicable in this study.

ETHICAL APPROVAL

Ethical approval has been obtained from DHA Medical Research Committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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