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# A Study on Serum Magnesium Levels In Acute Myocardial Infarction-Hypomagnesemia a Predictor of Arrhythmia"

Kandan Muralidharan[1], Arunachalam A[2],
[1]*Associate Professor, Department of Internal Medicine, Theni Medical College.*
[2]*Assistant professor ,Department of Internal Medicine Kilpauk Medical college .*

***Abstract***
***CONTEXT***
*In the human body, the proper fluid balance should be maintained, not only as a whole but between the three compartments of intracellular, interstitial and intravascular spaces. It is maintained by hemodynamic, electrolyte and other forces.Not only proteins, fats and carbohydrates, but also minerals are essential to life. Now the significance of traces not only of vitamins and other active organic substances, but also of minerals is under intensive investigation.*
*Magnesium has been implicated in the pathogenesis of Acute Myocardial Infarction and its complications like arrhythmias. It plays a significant role in other cardiovascular diseases also. Magnesium ions are considered essential for the maintenance of the functional integrity of the myocardium. Myocardial Magnesium concentration in patients with sudden death due to ischemic heart disease was found to be very low. It has been pointed out that Magnesium has a vital role in ventricular fibrillation and which causes sudden death in IHD. The coronary vasospasm can also be a part of Magnesium deficiency. It has been suggested as another important factor in the sudden death in IHD.*
*Magnesium deficiency was also have a role in the genesis of atheromatous plaques. Also myocardial infarction is one of the common causes of death at present where prognosis depends on multiple factor of which many still remain unexplained. This study is designed to know the relationship between serum Magnesium levels and arrhythmias in patients with acute myocardial infarction.*

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**AIM OF THE STUDY**
To know the relation between level of serum Magnesium and arrhythmias in patients with acute myocardial infarction who are presenting within 24 hours of onset of symptoms.

**SETTINGS AND DESIGN**
Analytical Case Control Study.

**MATERIALS AND METHODS**
**SOURCE OF DATA**
50 Cases of Acute Myocardial Infarction, admitted to Intensive Coronary Care Unit of Madurai Medical College Hospital over 6 months ie., between May 2017 to oct 2017.

**INCLUSION CRITERIA**
Patients were diagnosed to have Acute Myocardial Infarction, only if they had 2 of the following characteristics:
Chest Discomfort.
ECG features of Acute Myocardial Infarction.
Elevation of Cardiac Enzymes.
Only those patients presenting to the hospital within 24 hours of the onset of symptoms were included in the study.

**EXCLUSION CRITERIA**
Patients with hypokalemia.
Selected patients were subjected to detailed history and thorough physical examination and routine investigations like hemoglobin, Total leucocyte count, Urine examination.

**51**

**blood sugar, Blood urea, Serum creatinine, serum electrolytes , fasting lipid profile, cardiac enzymes and Echocardiography was done in all cases. Serum Magnesium level was done on Day-1 and Day-5.**

**METHOD OF SERUM MAGNESIUM ESTIMATION**
**Method: Calorimetric end point test.**
**Reagent: Xylidyl blue reagent.**
**Magnesium Standard: 2.5 mg/dl.**

**Principle:**
**At alkaline pH, Magnesium reacts with Xylidyl blue and produces a chelating red compound. The increase in red colour or decrease in blue colour is proportional to magnesium concentration.**

**SPECIMEN**
**Non hemolysed serum or Lithium Heparin plasma may be analysed since the magnesium concentration inside erythrocytes is 10 times greater than that in ECF, Hemolysis should be avoided and serum should be separated from the cell as soon as possible.**

**DATA COLLECTION**
**Informed consent has been obtained from all patient entrolled for the study. Patients are selected based on clinical symptoms, ECG and onset of symptoms.**

**REFERENCE RANGE FOR MAGNESIUM**
**Serum Magnesium: 1.6 -2.4 mg/dl**

**RESULTS**
This study was carried out in 50 patients of acute myocardial infarction who are admitted to the ICCU of MADURAI MEDICAL COLLEGE, MADURAI.
The male to female ratio in the study group was 2:1 and the th maximum incidence of acute myocardial infarction was seen in 6th and 7th decade.
In the study, the most common presentation symptom was chest pain
In the study, the most common risk factor found was smoking.
In the study group mean serum magnesium level in 50 patients on day-
is 1.28 ± 0.46 and day-5 is 2.32 ± 0.24

In the study group mean serum magnesium level in 38 patients with arrhythmia is 1.04 ± 0.17 on day-1 and 2.24 ± 0.23 on day-5.
In the study group, mean serum magnesium level in 12 patients without arrhythmia is 2.04 ± 0.21 on day-1 and 2.50 ± 0.16 on day-5

Total mortality rate is 16%.

**INTRODUCTION:**
Inorganic constituents are only a small part of human body, but they are very essential for sustaining life. Liebig (1803-1873) who recognized the importance of minerals as vital parts of plants and animals.

The name 'Magnesium' was coined Sir Humphrey Davy. It was obtained from the word 'Magnesia' which was an ancient Gracian town. In 1755, Joseph Black was discovered the Magnesium(Mg). He distinguished Magnesium oxide (MgO) from Calcium oxide (CaO). Magnesium Silicate was found out by Thomas Henry in 1789.

French scientist Antoine – Alexandre – Brutus - Bussy reacted Magnesium chloride with potassium and obtained a sizeable amount of Magnesium and carried out many studies on Magnesium. Greenberg described myocardial degeneration with polyplastic infiltration and fibroblast proliferation in rats, who were fed on a low Magnesium diet. Magnesium is an essential component of enzymes involved in oxidative phosphorylation. The abnormalities observed in rats were found to be sequelae to interference of function of these Magnesium dependant enzymes.
Until middle of 20th centuary, estimation and isolation of Magnesium was difficult and lacked uniformity in procedures. So the studies on Magnesium and its effects on human body were neglected for long time. But

reasonable amount of work on significance of Magnesium in non primates were available.

The availability of more accurate uniform methods for estimation of serum Magnesium in laboratory gave momentum to work on Magnesium metabolism in man.
Only 1% of total body Magnesium is in the extra-cellular fluid and of this about 25% is in the plasma, rest is in the red cells. Around 50% of serum Magnesium is free, 32% is protein bound and rest 13% is accounted for Magnesium phosphate, citrate and other unidentified complexes.
The vascular space constitutes a minor content of Magnesium concentration in the body, so the estimation of plasma concentration of ,Mg doesn't always impact the actual concentration of Mg in patients , but intracellular estimation of Mg levels are under research and not popularly available. (Vermon et al, 1978).

**MAGNESIUM METABOLISM**
Magnesium is the second most abundant cation in the Intra cellular fluid, after Potassium. It ranks fourth among other cations regarding abundance in the human body. Magnesium is not uniformly distributed among tissues of human body.
Magnesium is distributed in Human body according to the metabolic activity of tissues. Maximum concentration of Magnesium is found in Heart, Kidneys and Brain. Bone contains more than 50% of total body Magnesium content and this forms a exchangeable source that maintains normal serum Magnesium. Only one third of total body bone Magnesium is in exchangeable form [6].
Normal human adult body contains 20 – 24 gram of Magnesium or approximately 2000 milliequivalents(mEq) of Magnesium. Of this only 1% is found in the extracellular fluid. The normal serum Magnesium level is found to be 1.8 – 2.9 mg/dl. Only 25% of Magnesium in extracellular fluid is found in plasma. Of the total plasma Magnesium about 70% is ultra filterable. Free form of Magnesium constitutes about 50%.
Bound form of plasma Magnesium is bound to plasma proteins mainly Albumin. Cellular Magnesium levels in tissues varies with metabolic activity of tissues. Higher the metabolic activity higher the
levels of Magnesium.The normal cellular Magnesium level is between 1

– 3 mmol/L. Intracellular Magnesium levels may not always correlate with serum Magnesium levels, because only 25% of total extracellular Magnesium is found in serum. But cellular assays of Magnesium are not reliable and not widely available.

So serum Magnesium estimation remains as the best method to evaluate Magnesium deficiency or Magnesium excess.
and rapid epidemic spread beyond national borders

**MATERIALS AND METHODS**
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**STATISTICAL ANALYSIS**

- **DISCUSSION:** This study was carried out in 50 patients of acute myocardial infarction who are admitted to the ICCU of MADURAI MEDICAL COLLEGE, MADURAI.

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