RESEARCH ARTICLE

A STUDYOF SERUM MAGNESIUM LEVELS AND ITS RELATION TO ARRHYTHMIAS IN ACUTE MYOCARDIAL INFARCTION

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Manuscript Info	*Abstract*

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Introduction:-
Magnesium has been implicated in the pathogenesis of acute myocardial infarction and its complications like arrhythmias. Magnesium ions are considered essential for the maintenance of the functional integrity of themyocardium.

Investigations revealed that magnesium level in the blood is decreased in the first 48 hours following an acute myocardial infarction and then increased steadily to reach the normal level in about three weeks time. These findings directly correlated with the resultant complications of myocardial infarction, such asarrhythmias.

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, which causes sudden death in IHD.

Magnesium deficiency was also postulated to have role in the genesis of atheromatous plaques in that it leads to hyperlipidemia.This study is designed to know the relationship between serum magnesium levels and arrhythmias in patients with acute myocardial infarction.

Aims and Objectives:-
To know the relation between level of serum magnesium and arrhythmias in patients with acute myocardial infarction who are presenting within 12 hours of onset of symptoms.

Materials and Methods:-
Study subjects
50 cases of acute myocardial infarction, admitted in Katuri Medical College & Hospital over a period of 18 months between July 2019 and December 2020.

Type of study
It is a cross-sectional study

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Inclusion Criteria for Patients
Those patients presenting to the hospital within 12 hours of onset of symptoms were taken.Patients were considered to have acutemyocardial infarction, only if they had 2 of the followingcriteria:
1.   History of chest discomfort.
2.   ECG changes of acute myocardial infarction.
3.   Rise of cardiacenzymes.

ExclusionCriteria
Patients with hypokalemia.

Methodology:-
Cases selected were subjected to a detailed history and thorough physical examination, routine investigation like haemoglobin, blood count, urine examination, blood sugar, blood urea, serum creatinine, serumelectrolytes,fastinglipidprofile,cardiacenzymesandechocardiography was performed in all cases.Serum magnesium level were estimated on day-1 andday-5.

Method of Serum Magnesium Estimation Method
Colorimetric end pointtest

Reagent
Xylidyl blue reagent

Magnesium standard
2.5 mg/dL.

Principle
At alkaline pH, magnesium reacts with xylidyl blue and produces a chelating red colored compound. The red increasing (or) the blue decreasing color are proportional to magnesium concentration.

Specimen
Non- haemolyzed serum should be analyzed since the magnesium concentration inside erythrocytes is 10 times greater than that in the ECF, haemolysis should be avoided and serum should be separated from the cells as soon as possible.

Serum magnesium
1.6 – 2.4mg/dl.

Observations and Results:-
Table 1:- Age and Sex Distribution.

Age range (years)	Sex		Total
	Male	**Female**	
30 –40	10	--	10
40–50	14	2	16
50–60	5	5	10
60 – 70	11	1	12
70–80	2	-	2

In this study group of 50 cases, 42 were males and 8 were female patients with a male-female ratio of 5.25:1.
The maximum Incidence of acute myocardial infarction was seen in the 4th and 5th decades, followed by 6th and 7th decades. 28% patients were in the age group of 4th and 5th decade, 22werein the age group of60-70.
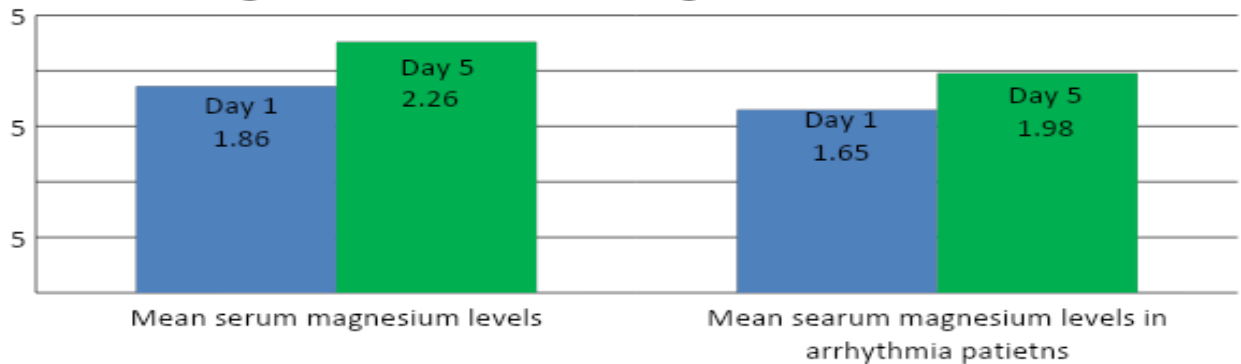
Table 2:- Serum magnesium levels in patients with arrhythmias.

Serummagnesium levels (mg/dl)	Day-1	Percent	Day-5	Percent

<1.6	8	16.00	2	4.00
1.6 to 2.40	17	34.00	16	32.00
>2.4	--	--	2	4.00

Table 3:- Serum magnesium levels in patients without arrhythmia.

Serum magnesium levels (mg/dl)	Day-1	Percent	Day-5	Percent
<1.6	2	4.00	--	--
1.6 to 2.40	17	34.00	14	28.00
>2.4	6	12.00	9	18.00

Figure 1: Mean serum magnesium levels

Table 4:- Mean serum magnesium level.

	Day-1	Day-5
Mean serum magnesium in 50 cases	1.86±0.39	2.26±0.50
Mean serum magnesium level in patients with arrhythmia(25patients)	1.65±0.26	1.98±0.25

Serum magnesium in Acute Myocardial Infarction in Relation to Arrhythmia
In this cross sectional study of 50 patients, the mean serum magnesium level on day-1 in all 50 patients was 1.86±0.39 and the mean serummagnesium level on day-5 was 2.26±0.5.

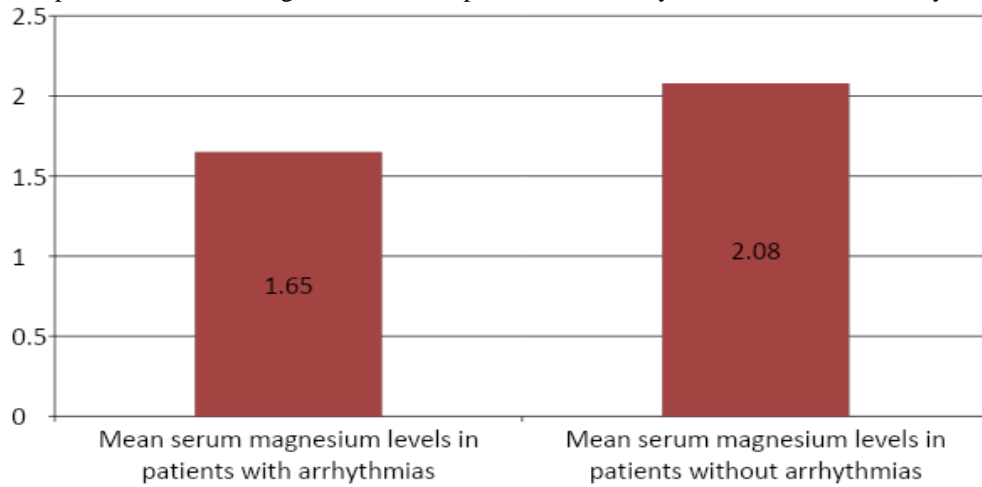**Mean serum magnesium level in the group with Arrhythmia on Day-1 andDay-5**
In the present study, out of 50 patients, 25 patients had significant ventricular premature contractions/ ventricular tachycardia/ ventricular fibrillation during their 5-days course in the hospital.

Table 5:- Comparison of Serum Magnesium level in patients with Arrhythmias and without Arrhythmias(Day-1).

	No. of cases	Serum magnesium Day-1	t- value	p-value
Mean serum magnesium level in patients with arrhythmia	25	1.65±0.26	4.63	<0.001
Mean serum magnesium level in patients without arrhythmia	25	2.08±0.41		

The above table shows that out of 50 patients, 25 patients had arrhythmias. The mean value of serum magnesium on day-1 those with arrhythmias is 1.65±0.26, those without arrhythmias is 2.08±0.4 (p<0.001). There is a significant difference in the magnesium level in patient with arrhythmias and without arrhythmias.
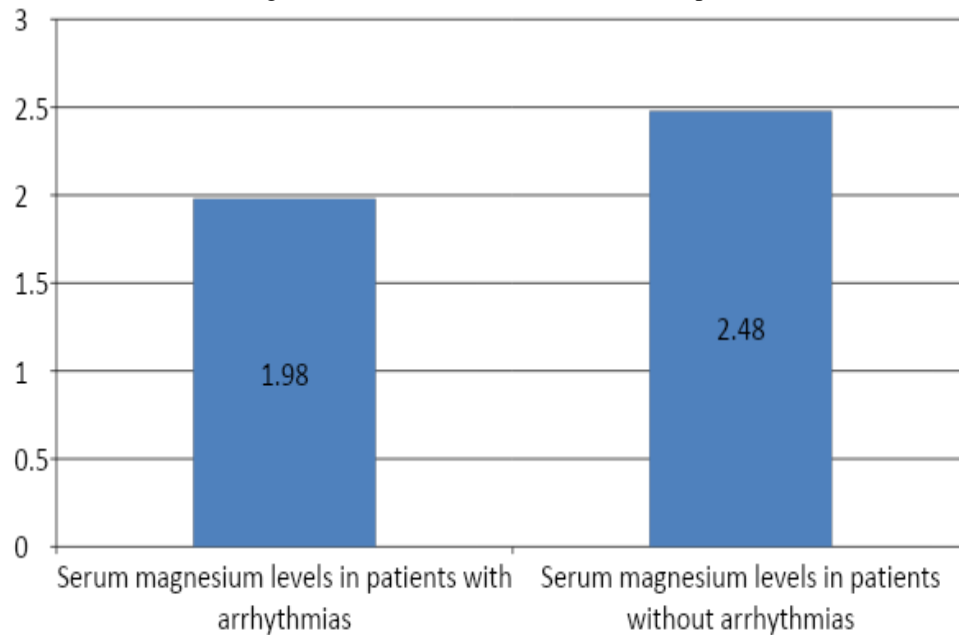
Figure 2:- Comparison of Serum Magnesium level in patients with Arrhythimas and without Arrhythmias (Day-1).

Table 6:-Comparison of Serum Magnesium level in patients with Arrhythimas and without Arrhythmias(Day-5)

	No. of cases	Serum magnesiumDay-5	t-value	p-value
Mean serum magnesium level in patients with arrhythmia	20	1.98±0.25	4.17	<0.001
Mean serum magnesium level in patients without arrhythmia	23	2.48±0.52		

The above table shows that serum magnesium in patient with arrhythmia on Day-5 is 1.98±0.25, those without arrhythmia is 2.48±0.52. There is a significant difference between these two (p<0.001).

Figure 3:- Comparison of Serum Magnesium level in patients with Arrhythimas and without Arrhythmias (Day-5).

Mortality
In the above study of 50 patients, 7 patients died during their 5-dayhospital course. 5 patients died of ventricular tachycardia or ventricular fibrillation, 2 patients died of cardiogenic shock. Mortality percentage was 14%.

Discussion:-

Magnesium ion has emerged as a premier cardiovascular cation during the decade. It has been implicated in the pathogenesis of acute myocardial infarction and complication like arrhythmias. Magnesium is essential for activation of ATP, which maintains the sodium-potassium pump and also because of calcium blocking action, magnesium has been implicated in relation to arrhythmias after acute myocardialinfarction.

In the study group of 50 patients, 42 were males and 8 were females with a male-female ratio of 5.25:1. The maximum incidence of acute myocardial infarction was seen in the 4th and 5thdecades.

In the present study of 50 patients, the mean serum magnesium level on day-1 in all 50 patients was 1.86±0.39 and the mean serum magnesium level on day-5 was2.26±0.5.

Abraham et al[3] reviewed magnesium level of 65 consecutive patients with an admission diagnosis of acute myocardial infarction. Serum magnesium concentration were low in patients who had AMI (mean1.70mg/dl,p<0.001)oracutecoronaryinsufficiency(mean1.61 mg/dl, p<0.01), but not in the control group or patients with non- cardiac chest pain (mean 1.91 mg/dl).

Singh A et al[4] checked serum magnesium levels of twenty patients of acute myocardial infarction on the 1st, 7th and 12th day of admission. In all the cases, there was a significant fall of serum magnesium on the firstday.

Dimtruk[5] in his series of 67 patients of ischemic heart disease showed a distinct reduction of plasma magnesium during the first 3 days following onset of disease, the level normalized by 15-25 days from onset of the disease.

Sachdev et al[6] (1978) in 30 patients of myocardial infarction determine the magnesium levels within 24 hours, 5th and 8th day and reported as 1.83±0.087 mg%, 1.91±0.149 and 1.97±0.089 as against control of 2.44±0.162 mg%. The values were statistically lower on all the three days showing a progressive rise.

In the present study, the serum magnesium level on day-1 was significantly lower in patients with arrhythmias than those without arrhythmia (p<0.001). There was an increase in serum magnesium from Day-1 to Day-5 in both those with arrhythmias and those withoutarrhythmias.

Ceremuzynski et al[7] assigned 48 patients with acute myocardial infarction over 24 hour infusion of magnesium or placebo. The incidence of ventricular tachycardia (3 or more consecutive premature ventricular contraction at a rate faster than 120/ min) recorded by Holter monitoring was significantly reduced (p<0.001), but the incidence of other ventricular arrhythmias was not statisticallydifferent.

Raismusen et al[8] randomized 273 patients with suspected acute myocardial infarction to intravenous magnesium or placebo. There is a significant decrease in the ventricular arrhythmia in the magnesium group compared to placebo(p<0.05).

Shecter et al[9] randomized 103 patients with documented acute myocardial infarction to 48 hour infusion of magnesium or placebo. There is a significant decrease in mortality (p<0.01). There was also a non-significant decrease in the number of tachyarrhythmias requiring treatment (10/50) in the magnesium group compared to control(24/53).

Smith et al[10] randomized 400 patients with suspected AMI to a 24 hour infusion of magnesium sulphate or placebo. Two hundred patients had confirmed acute myocardial infarction. The difference in mortality and incidence of ventricular arrhythmias requiring treatment between magnesium and placebo groups were not statistically significant.

Abraham et al[11] randomly assigned 94 patients with acute myocardial infarction to receive a daily magnesium bolus of 30 mmol or placebo for 3- days. There was no significant difference in mortality or lethal arrhythmias between patients treated with magnesium and those treated withplacebo.

Felstedt et al[12] randomized 298 patients with suspected acute myocardial infarction to 24 hour infusion of magnesium or placebo. Myocardial infarction was documented in 162 patients. During the mean observation period of 245 days, there was no difference in the incidence of tachyarrhythmias, magnesium infusion was associated with a significant increase inbradyarrhythmias.

Singh et al[13] randomized 264 patients with suspected acute myocardial infarction to magnesium, potassium, 10% glucose or 2% glucose infusion. Myocardial infarction was confirmed in 228 patients. Mortality and ventricular tachycardia or fibrillation did not differ significantly between the magnesium group and placebo group.

Morton et al[14] randomized 76 patients to receive either magnesiuminfusion0.38 mmol /l per kg every 12 hour or placebo over the first 36 hours of hospital, there was no difference in the incidence of ventricular tachycardia.

Dyckner T et al[15] during their 1½ years, 905 admissions, 342 with acute myocardial infarction, 563 other diagnoses were treated in the ICCU on admission both acute myocardial infarction and non AMI group had significantly lower serum magnesium level than as reference group. The incidence of serious ventricular premature beats, ventricular tachycardia and ventricular fibrillation on admission was significantly higher in the hypomagnesemic patients with acute myocardialinfarction.

Conclusions and Summary:-
This study was carried out in 50 patients of acute myocardial infarction who were admitted to the ICCU of Katuri Medical college andhospital.
1. The male to female ratio in the study group was 5.25:1 and the maximum incidence of acute myocardial infarction was seen in 4th and 5thdecade.
2. In the study group mean serum magnesium level in 50 patients on day-1 is 1.86±0.39 and on Day-5 is2.26±0.5.
3. In the study group mean serum magnesium level in 25 patients with arrhythmia is 1.65±0.26 on day-1 and 1.98±0.25 onday-5.
4. In the study group, mean serum magnesium level in 25 patients without arrhythmia is 2.05±0.41 on day-1 and 2.48±0.52 onday-5.
5. The difference between the magnesium level in patients with arrhythmia and without arrhythmia is statically significant on both day-1 andday-5.

In the present study, patients with acute myocardial infarction with low magnesium levels are more prone to developer 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.

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