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A STUDY ON THE ROLE OF SERUM ELECTROLYTES, IN THE DEVELOPMENT OF ARRHYTHMIA IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION.

General Medicine

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ABSTRACT

Background:- The electrical activity of the heart is regulated by Electrolytes (calcium, potassium and sodium etc) whereas cardiac contraction requires calcium, magnesium and phosphorus. In the infarction, the injured myocyte because of disruption of cell membrane is playing key role in the development of complications like arrhythmias.

Objectives:- Present study was conducted to know the association between electrolyte levels in the development of complications like arrhythmias in the acute cases of Myocardial infarction.

Methods:- Hospital based observational comparative study. AMI with Arrhythmia group (A) cases electrolyte values were compared with AMI without Arrhythmia group (B).

Results:- The mean sodium levels in Group A was 128 ± 6.4 mmol/L and in Group B it was 129.6 ± 5.4 mmol/L. The mean serum potassium levels in Group A was 3.45 ± 0.15 mmol/L and in Group B it was 3.59 ± 0.2 mmol/L. The mean serum Magnesium levels in Group A was 1.28 ± 0.28 mg/dl and in Group B it was 1.84 ± 0.32 mg/dl. The difference in mean electrolyte levels in both groups was statistically highly significant ($p<0.01$) except for sodium.

Conclusion:- Estimation of Serum electrolytes specifically potassium, sodium and magnesium levels in patients with chest pain can help in early diagnosis of acute MI with arrhythmias

KEYWORDS

Arrhythmia, Acute myocardial infarction, Serum electrolyte

INTRODUCTION:

Myocardial infarction (MI) is one of the five main manifestations of coronary heart disease, namely stable angina pectoris, unstable angina pectoris, MI, heart failure and sudden death[1]. According to World health organization there are 32.4 million myocardial infarctions and strokes worldwide every year. Patients with previous stroke and myocardial infarction (MI) are the highest risk group for further coronary and cerebral events. Recurrent infarctions have an annual death rate of 5%. Similarly, patients who have suffered a stroke remain at an increased risk of a further stroke (about 7% per annum). [2] In acute myocardial infarction (AMI), the major cause of morbidity and mortality was due to fatal arrhythmias like, Ventricular tachycardia (VT) and ventricular fibrillation (VF). [3,4]

Electrolytes which are present in the human body are responsible for the balance of normal function of our cells and organs. The functioning heart is dependent upon normal levels of magnesium, calcium, potassium etc. The electrical activity of the heart is regulated by calcium, potassium and sodium whereas contraction of the heart requires calcium, magnesium and phosphorus. The myocyte injured in the infarction because of disruption of cell membrane is playing key role in the development of complications like arrhythmias. [5,6]

Thus, present study was done to know the relationship between electrolyte levels in the development of complications like arrhythmias in the acute cases of Myocardial infarction.

AIMS AND OBJECTIVES:

To know the relation between level of serum electrolytes (magnesium, potassium and sodium) and arrhythmias in patients with acute myocardial infarction who are presenting within 12 hours of onset of symptoms.

METHODOLOGY:

Study Area:

This is a hospital based observational comparative study conducted in Medical emergency department of Surabhi Institute of Medical Sciences Siddipet-Husnabad, Mundrai, Telangana.

Study Population:

Patients who were diagnosed to have Acute Myocardial Infarction by ECG features of Acute Myocardial Infarction (AMI) and Elevation of Cardiac Enzymes and patients presenting to the hospital within 12 hours of the onset of symptoms were included in the study.

Sample Size: -

100 cases of Acute Myocardial Infarction were recruited by convenient method and they were divided into two groups based on the presence of arrhythmia. Presence of Arrhythmia within first 5 days after admission was considered. Group A had 50 cases of AMI with arrhythmia and Group B had 50 cases of AMI without arrhythmia.

Study Period:

The study is conducted from DEC 2019 to JUNE 2020 for a period of 7months.

Study Tools:

All the cases were estimated for serum electrolytes at the time of admission. Magnesium (normal range 1.7 to 2.4 mg/dl), potassium (normal range 3.5-5.5mmol/L) and sodium(normal range 136-145mmol/L) were considered for this study.

Data Analysis:

Data was entered in MS-excel 2007 and was analyzed using SPSS software trial version 22.Relevant statistical tests (Chi-square Test, T test) were applied and $p<0.05$ is considered as statistical significance.

Ethical Clearance:

Ethical clearance was taken from the ethical committee of Surabhi Institute of Medical Sciences and Informed consent was taken from the study subjects before doing this study.

Conflict Of Interest:-

there was no conflict of interest in the present study.

Funding:- No external funding is involved.

RESULTS:

In this current study, All AMI cases were treated and observed in intensive care unit and their serum electrolytes value were estimated and AMI with Arrhythmia group (A) cases values were compared with AMI without Arrhythmia group (B). Mean age of male patients was 62.4±9.3 and female patients was 43.2±10.3years.

Table No.1 Distribution Of Age Groups

AGE GROUPS (Years)	GROUP A		GROUP B		P VALUE
	N	%	N	%	
21 TO 40	13	26	14	28	0.9

41 TO 60	22	44	19	38	NOT SIGNIFIC ANT
61 TO 80	15	30	17	34	
TOTAL	50	100	50	100	

Table 1 is showing, In both Group A and B Majority (44% and 38% respectively) were the age group of 41 to 60 years and the difference between the groups were not found to be significant.

Table No.2 Distribution Of Gender

GENDER	GROUP A		GROUP B		P VALUE
	N	%	N	%	
MALE	36	72	37	74	0.8 NOT SIGNIFIC ANT
FEMALE	14	28	13	26	
TOTAL	50	100	50	100	

In this study, 72% were males and 28% were females in Group A and 74% were males and 26% were females in Group B. The difference between both the groups with relation to gender was found to be statistically not significant.

Table No.3 Distribution Of COMORBID Conditions

COMORBID CONDITIONS		GROUP A	GROUP B	P VALUE
HYPERTENSION	PRESENT	35	34	0.8 NOT SIGNIFIC ANT
	ABSENT	15	16	
DIABETES	PRESENT	30	27	0.54 NOT SIGNIFIC ANT
	ABSENT	20	23	

Almost 70% of patients in group A and 68% of patients in group B had Hypertension. Around 60% of patients in Group A and 54% of patients in Group B had Diabetes. The difference in both the groups with relation to co-morbidities was found to be statistically not significant and the groups were comparable.

Table No.4 Distribution Of Electrolytes

ELECTROLYTES	LEVEL	GROUP A	GROUP B	P VALUE
SODIUM	< 136	9	6	0.4 NOT SIGNIFIC ANT
	136-145	33	39	
	>145	8	5	
POTASSIUM	<3.5	10	3	0.02 SIGNIFIC ANT
	3.5-5.5	28	40	
	>5.5	12	7	
MAGNESIUM	< 1.7	12	8	0.006 SIGNIFIC ANT
	1.7-2.4	27	41	
	>2.4	9	1	

In group A study subjects – i.e. AMI with Arrhythmias, it was found that 18% had serum Sodium levels <136 mmol/L, 66% had normal serum sodium levels i.e. 136 – 145 mmol/L and 16% had >145 mmol/L. Around 20% study subjects had potassium levels <3.5 mmol/L, 56% had normal potassium levels i.e. 3.5 – 5.5 mmol/L and 24% had >5.5 mmol/L. Magnesium levels were <1.7 mg/dl in about 24% of patients, 54% had normal magnesium levels i.e. 1.7 – 2.4 mg/dl and 18% had >2.4 mg/dl.

In group B study subjects – i.e. AMI without Arrhythmias, it was found that 12% had serum Sodium levels <136 mmol/L, 78% had normal serum sodium levels i.e. 136 – 145 mmol/L and 10% had >145 mmol/L. Around 6% study subjects had potassium levels <3.5 mmol/L, 80% had normal potassium levels i.e. 3.5 – 5.5 mmol/L and 14% had >5.5 mmol/L. Magnesium levels were <1.7 mg/dl in about 16% of patients, 82% had normal magnesium levels i.e. 1.7 – 2.4 mg/dl and 2% had >2.4 mg/dl.

The difference in the serum sodium levels in Group A and Group B was statistically not significant and difference in serum potassium and serum magnesium levels was statistically highly significant. (p<0.01)

Table No.5 Distribution Of Electrolytes (MEAN + SD)

ELECTROLYTE (MEAN + SD)	GROUP A	GROUP B	P VALUE
SODIUM	128.1±6.4	129.6±5.4	0.2 NOT SIGNIFICANT
POTASSIUM	3.45±0.15	3.59±0.2	0.0005 SIGNIFICANT
MAGNESIUM	1.28 ± 0.28	1.84 ± 0.32	0.0001 SIGNIFICANT

The mean sodium levels in Group A were 128 ± 6.4 mmol/L and in Group B it was 129.6 ± 5.4 mmol/L. The difference in mean sodium levels was found to be statistically not significant.

The mean serum potassium levels in Group A were 3.45 ± 0.15 mmol/L and in Group B it was 3.59 ± 0.2 mmol/L. The difference in mean potassium levels in both groups was statistically highly significant. (p<0.01)

The mean serum Magnesium levels in Group A were 1.28 ± 0.28 mg/dl and in Group B it was 1.84 ± 0.32 mg/dl. The difference in mean Magnesium levels in both groups was statistically highly significant (p<0.01).

DISCUSSION:

In this current study, All AMI cases were treated and observed in intensive care unit and their serum electrolytes value were estimated and AMI with Arrhythmia group (A) cases values were compared with AMI without Arrhythmia group (B). Mean age of male patients was 62.4±9.3 and female patients was 43.2±10.3years.

In this study, in both Group A and B majority (44% and 38% respectively) were in the age group of 41 to 60 years and the difference between the groups were not found to be significant.

The present study findings were similar to a study conducted by Shilpa P et al in which the mean age of cases was 62.89 ± 11.85 years.[7]

In this study, 72% were males and 28% were females in Group A and 74% were males and 26% were females in Group B.

The present study findings were consistent with a study conducted by Shilpa P et al in which male preponderance was seen among both cases and controls.[7]

Almost 70% of patients in group A and 68% of patients in group B had Hypertension. Around 60% of patients in Group A and 54% of patients in Group B had Diabetes. The difference in both the groups with relation to co-morbidities was found to be statistically not significant and the groups were comparable.

The present study findings were comparable with a study by Hari prasad et al in which diabetics and Hypertensives had most episodes of acute MI and also deranged electrolyte imbalance. [8]

The mean sodium levels in Group A were 128 ± 6.4 mmol/L and in Group B it was 129.6 ± 5.4 mmol/L. The difference in mean sodium levels was found to be statistically not significant. Around 18% in Group A and 12% in Group B were hyponatremic and 16% in Group A and 10% in Group B were hypernatremic. The difference in the serum sodium levels in Group A – i.e. AMI with arrhythmias and Group B – AMI without Arrhythmias was statistically not significant.

The present study findings were different as compared to a study conducted by Shilpa P et al in which the occurrence of hyponatremia was statistically significant among patient with MI and Arrhythmias.[7]

The present study findings were different to a study by Hari prasad et al in which there was significant hyponatremia among patients with acute myocardial infarction.[8]

The present study findings were similar to a study conducted by Flear C T G et al in which hyponatremia was more commoner finding in patients with myocardial infarction and was associated with increasing mortality.[9]

The present study findings were different as compared to a study by Soubhagya et al in which mean sodium concentration of subjects was 135 mEq/l ± 4.9mEq/l and majority of patients had normal serum sodium levels.[10]

The present study findings were similar to a study by Vinod Wali et al in which mean serum sodium levels among patients with acute MI was

129.47 ± 4.87 m Eq/L.[11]

The present study findings were different as compared to a study by Amita A et al in which mean serum sodium levels was high as compared to our study.[12]

The present study findings were similar to a study conducted by ShubhangiVerma et al in which hyponatremia was slightly higher among patients with acute MI.[13]

In this study, the mean serum potassium levels in Group A were 3.45 ± 0.15 mmol/L and in Group B it was 3.59 ± 0.2 mmol/L. The difference in mean potassium levels in both groups was statistically highly significant. ($p<0.01$). Around 20% of patients who had MI and arrhythmias had Hypokalemia and only 6% of patients who had MI without arrhythmias had hypokalemia. The difference was found to be statistically significant in both the groups. In this study, it was also observed that 24% of patients in Group A had Hyperkalemia and 14% in Group B had Hyperkalemia. This difference in both the groups was found to be statistically significant.

The present study findings were similar to a study by Shilpa P et al in which hypokalemia was significantly higher among cases than controls.[7]

The present study findings were similar to a study conducted by Hariprasad et al in which hypokalemia was significantly associated with acute Myocardial Infarction.[8]

The present study findings were almost similar to a study by Soubhagya P et al in which mean potassium concentration was3.9± 0.59 mEq/l.[10]

The present study findings differed with a study conducted by Vinod wali et al and Amita A et al in which mean potassium concentration was higher as compared to our study. [11,12]

The present study findings were consistent with a study by Solomon R J et al in which hypokalemia was significantly higher among infarcted patients.[14]

In this study, the mean serum Magnesium levels in Group A were 1.28 ± 0.28 mg/dl and in Group B it was 1.84 ± 0.32 mg/dl. The difference in mean Magnesium levels in both groups was statistically highly significant ($p<0.01$). Hypomagnesemia was found in 24% of Group A patients and 16% of Group B patients and Hypermagnesemia was found in 18% of Group A patients and 2% of Group B patients. The difference was found to be statistically significant.

The present study findings were different with a study conducted by Hariprasad et al in which hypomagnesemia was not a significant finding among patients with acute myocardial Infarction.[8]

The present study findings were consistent with a study by Dhanesh M et al in which hypomagnesemia was a significant finding in patients with acute MI.[15]

CONCLUSIONS:

1.Estimation of Serum electrolytes specifically potassium, sodium and magnesium levels in patients with chest pain can help in early diagnosis of acute MI with arrhythmias.
2.Hyponatremia, hypokalemia and hypomagnesemia are significant findings among patients with acute MI with arrhythmias as compared to those without arrhythmias.
3.Magnesium and potassium supplementation in patients with acute MI may reduce the incidence of arrhythmias.

LIMITATION: -

Sample size was relatively small and other electrolytes like calcium, chloride etc were not explored. Outcome in terms of mortality and survival was not assessed in both the groups.

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