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A study of hyponatremia in acute St elevation mi and it's prognostic significance

Arya Satheesh[1], Kadappa Jaligidad[2]
[1](General medicine,S.Nijalingappa medical college(RGUHS), India
[2](General medicine Department,S.Nijalingappa medical college(RGUHS), India)

Abstract:
***Background*: :** *Hyponatremia has been shown to be a predictor of cardiovascular mortality among patients with heart failure. In fact, the neurohormonal activation that accompanies acute myocardial infarction is similar to that which accompanies heart failure.Hence we aimed to investigate the prognostic importance of hyponatremia in the setting of acute ST elevation MI and to determine its usefulness in predicting short-term survival.*
Materials and Methods*: The study was carried out on patients presenting with acute ST-elevation Myocardial infarction coming to HSK hospital fulfilling inclusion and exclusion criteria.The sampling methodwasHospital-based Case series study and the Sample size was100.Patients of acute ST-elevation myocardial infarction diagnosed by ECG along with the cardiac panel, underwent serial plasma sodium levels testing on admission, 24, 48 and 72 hours thereafter.The primary endpoint was all-causes of mortality within 10 days following myocardial infarction.*
Results*:: In our study, substantial proportion of patients presented with acute ST elevation myocardial infarction were hyponatremic on admission or developed hyponatremia shortly after admission. The odd's ratio for 30-day mortality was found to be high in hyponatremic groups compared to normal group. We also found a significant linear relationship between severity of hyponatremia and mortality. Multivariate analysis was done which identified hyponatremia on admission or early development of hyponatremia as a significant independent predictor of 30 day mortality.*
Conclusion:: *In our study we concluded that hyponatremia on admission or early development of hyponatremiain patients with acute ST elevation myocardial infarction is an independent predictor of 30-day mortality. Plasma sodium levels may serve as a simple marker to identify patients at risk.*
Key Word*: .Acute myocardial infarction,Hyponatremia.*

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I. Introduction

Myocardial infarction is a condition in which there is an inadequate supply of blood and oxygen to a portion of the myocardium, The most common cause of myocardial ischaemia is atherosclerotic disease of an epicardial coronary artery (or arteries) sufficient to cause a regional reduction in myocardial blood flow and inadequate perfusion of the myocardium supplied by the involved coronary artery[1]. It is the most common, serious chronic, life threatening illness. Hyponatremia is a common electrolyte disorder amongst hospitalized patients, especially in the postoperative period and in patients with heart failure,nephrotic syndrome or cirrhosis[2,3]. Hyponatremia has been shown to be a predictor of cardiovascular mortality among patients withheartfailure.In fact, the neurohormonal activation that accompanies acute myocardial infarction is similar to that which accompanies heart failure[4,5]. Hyponatremia is common after MI,and clinicalimprovement is accompanied rise in plasma sodium concentration. However, while the prognostic value in hyponatremia in chronic heart failure has well established, data on the prognostic importance of hyponatremia in the setting of acute myocardial infarction are lacking[6,7]. Hyponatraemia, though a marker, can also contribute to the worsening haemodynamics by impairing contraction and relaxation of myocardial cells, decreasing the diastolic membrane potential and abolishing electrical coupling between myocytes[8,9].Hence, it is worth to evaluate the incidence of hyponatraemia in patients with acute ST elevation myocardial infarction in Intensive Coronary Care Unit & to find out whether hyponatraemia serves as a poor prognostic indicator in these patients.

II. Material And Methods

ThisHospital based Case series studywas carried out on patients of Department of general Medicine at S.Nijalingappa medical college ,Bagalkot ,Karnataka. A total 100 adult subjects (both male and females) of aged ≥ 21 years were for in thisstudy.

Study Design: Hospital based Case series study
Study Location: This was a tertiary care teaching hospital based study done in Department of General Medicine, S.Nijalingappa medical college ,Bagalkot ,Karnataka
Study Duration:2022 to 2023.

Sample size: 100 patients.
Sample size calculation: The sample size wasestimation was done using openepi software version 2.3.1. At 95% confidence level, and 80% power of the study.According to the study conducted by ()
The proportion of Acute MI patients who had hyponatremia 29%=p At 10%, Absolute precision,
Sample size estimated is 80Formula used n= [DEFF*Np(1-p)]/ [(d2/Z21-α/2*(N-1)+p*(1-p)]
Subjects & selection method:All the cases which satisfy the inclusion criteria and exclusion criteria will be included in the study. Written informed consent (in English and local language) was taken from all study subjects, before enrolment in the study.Qualifying patients will undergo detailed history and clinical examination. Patients of acute ST-elevation myocardial infarction diagnosed by ECG along with the cardiac panel, undergo serial plasma sodium levels testing on admission, 24, 48 and 72 hours thereafter.The data was analysed.
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Inclusion criteria:

Age group: 21- 80.
Patients with ECG proven acute ST elevation MI
Elevated creatinine kinase MB levels or elevated cardiac troponin T or I levels

Exclusion criteria:

Acute coronary syndrome without ST elevation.
Age less than 21 yrs of age
Pre-existing Renal diseases, heart failure on diuretic therapy

Procedure methodology

After obtaining clearance from Institution Ethical Committee, the study was conducted in the Medicine ward of SNMC. This study was a hospital-based case series study . All the cases which satisfy the inclusion criteria and exclusion criteria was included in the study. Written informed consent (in English and local language) will be taken from all study subjects, before enrolment in the study.Qualifying patients will undergo detailed history and clinical examination. Patients of acute ST-elevation myocardial infarction diagnosed by ECG along with the cardiac panel, undergo serial plasma sodium levels testing on admission, 24, 48 and 72 hours thereafter.Plasma sodium concentrations were determined by using an ion selective electrode auto analyzer (Roche OMNI C) Hyponatremia was defined as sodium level less than 135mmol/L (<135 mEq/L)The primary endpoint was all-causes of mortality following myocardial infarction.

Statistical analysis
Statistical analysis will be done using SPSS software 19.0.
Data obtained will be tabulated in the Excel sheet and will be analysed.
Quantitative data will be expressed as mean + standard deviation and nonparametric data will be expressed as median and min-max values. Percentages are used for representing qualitative data.
Chi-square test for proportions in qualitative data. Student's unpaired t – test for Quantitative data. Other appropriate statistical tests will be applied. P< 0.05 will be considered statistically significant.

III. Result

Table no 1 TABLE 1: SHOWING AGE DISTRIBUTION OF CASES

Age group Yrs	Frequency cases	Percentage
21-30	4	4
31-40	10	10
41-50	23	23
51-60	31	31
61-70	24	24
71-80	6	6

81-90	**2**	**2**
Total	**100**	**100**

Out of the 100 patients 4(4%) were in the age group of 21-30yrs,10(10%)were in the age group of 31-40yrs, 23(23%) were in the age group of 41-50yrs, 31(31%) were in the age group of 51-60yrs, 24(24%) were in the age group of 61-70yrs, 6(6%) were in the age group of 71-80yrs and 2(2%) were in the age group of 81-90yrs. The youngest age was 26 years. The eldest age was 86 years. The maximum numbers of patients were in the age group 51-60 which is 31% of the cases and next highest numbers of patients were found in the age group 61-70 (24%).

SEX DISTRIBUTION:

Table 2: TABLE SHOWING SEX DISTRIBUTION

Patients	**Cases**
Males	78
Females	22
Total	**100**

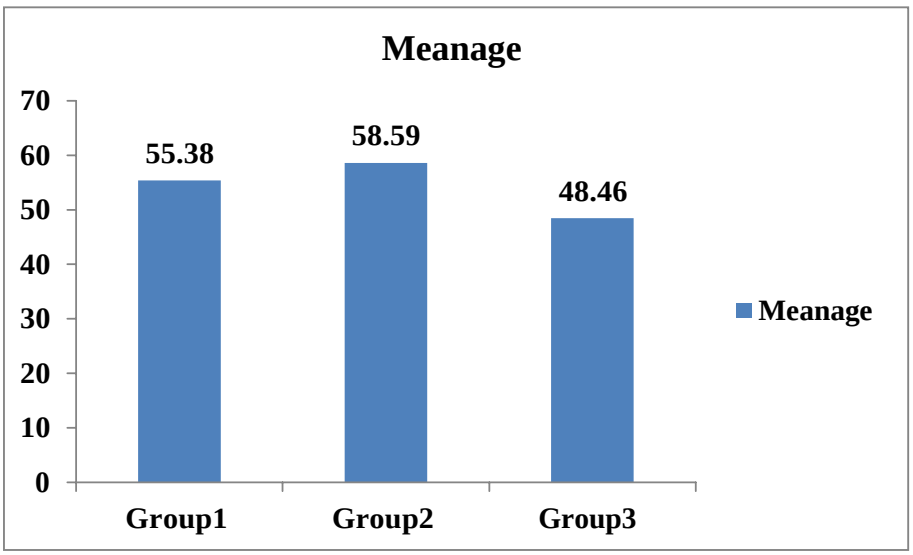
Among 100 patients studied, 78% were Males and 22% were Females. In this study, ratio is M: F=4:1

TABLE 3 shows Patients presented with hyponatremia on admission were older than patients with normal sodium levels. Males made up 75.9% of patients who presented with hyponatremia on admission and 100% of patients who developed hyponatremia within 72 hours. Patients who presented with or developed hyponatremia more often were lower ejection fraction (47.86 ±7.145) compared to patients with normal sodium levels.

Table 3: TABLE SHOWING BASE LINE CHARACTERISTICS OF 100 PATIENTS

Characteristics	**Normal sodium level(n=58)**	**Hyponatremia on Admission (n=29)**	**Hyponatremia within 72 hrs (n=13)**	**P value**
	MEAN ±SD, NUMBER (%) OR MEDIAN			
Age(yrs)	55.38 ± 12.333	58.59 ±12.836	48.46± 13.776	F= 2.868 p=0.062
Male sex	43 (74.1)	22 (75.9)	13 (100)	χ 2= 4.284 p=0.12
Ejection fraction (%)	49.76±5.066	47.86±7.145	49.62±5.709	F=2.693 p=0.073

Graph 4 : Mean age in study groups

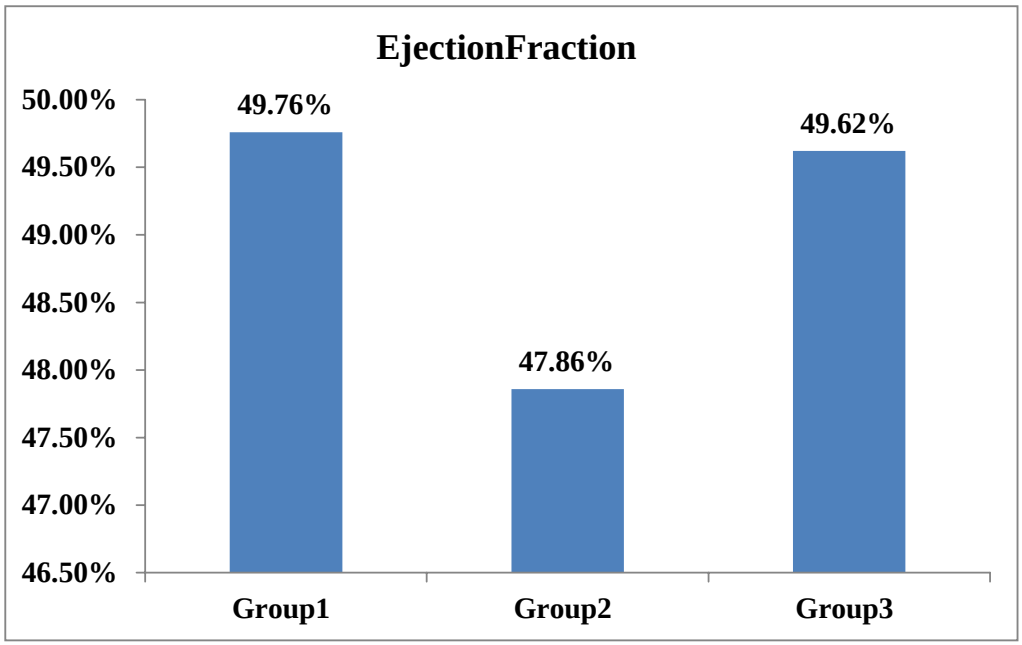


Group1=patients with normal sodium levels Mean age in group 1 was 55.38.

Group2=hyponatremia on admission. Mean age in group 2 was 58.59.

Group3= hyponatremia within 72 hours. Mean age in group 3 was 48.46.

Graph 5 :EF(%) in various groups



Group1=patients with normal sodium levels Mean EF(%) was 49.76%.

Group2=hyponatremia on admission. Mean EF(%) was 47.86%.

Group3= hyponatremia within 72 hours. Mean EF(%) was 49.62%.

Table 5:Showing Hyponatremia on admission and at 72 hours and outcome in terms of mortality

	Normal sodium levels	**Hyponatremia on admission**	**Hyponatremia within 72 hours**	**Total**
No. of patients	58	29	13	100
Mortality in each group at the end of 30 days	2 (3.44%)	7 (24.1%)	1 (7.69%)	10 (10%)

Mortality in patients with normal sodium levels was 2(3.44%) out of 58.

Mortality in patients developing hyponatremia on admission was 7(24.1 %) out of 29.

Mortality in patients developing hyponatremia within 72 hours was 1(7.69%) out of 13.
A total of 10 deaths(10%) occurred out of 100.

Table 6: Showing severity of Hyponatremia and outcome in terms of mortality

Range of Sodium levels in hyponatremia patients	**No. of patients**	**Mortality**
<130	7	4(57.14%)
131-134	25	4(16.11%)

Number of patients with sodium levels less than 130 is 7 and mortality was 4(57.14%).
Number of patients with sodium levels between 131-134 is 25 and mortality was 4(16.11%).

Table 6:ODDS RATIO FOR 30 DAY MORTALITY GROUP 1 VERSUS OTHERGROUPS

	Survivors	**Non survivors**	**Odds ratio**	**P value**
Group1	56	2		
Group2	22	7	**3.143**	**0.008**
Group3	12	1	**12.0**	**0.017**

Group1=patients with normal sodium levels
Group2=hyponatremia on admission.
Group3= hyponatremia within 72 hours.

Odds ratio for 30 day mortality was found to be high in hyponatremic groups.(Group2=3.143, Group3=12.0)

Table no 7 Showing results of multivariate analysis

	Mean Square	F	—p‖ Value
Age	.007	.384	.537
Sex	.000	.026	.873
Sodium on Admission	.140	**8.021**	**.006**
Sodium at 72 hours	.009	.488	.487
Ejection Fraction	.002	.125	.725

So, multivariate analysis showed that along with other risk factors, hyponatremia was the significant independent predictor of 30 day mortality

IV. Discussion

Our study suggests that patients presenting with acute myocardial infarction who had hyponatremaia on admission or developed hyponatremia after admission represent high risk population.

In our study substantial proportion of patients who presented with acute ST elevation myocardial infarction were hyponatremic on admission or developed hyponatremia shortly after admission i.e hyponatremia was present on admission in 29 patients (29%). Hyponatremia developed in 13 patients(13%) during the first 72 hours of hospitalisation. In a similar study conducted by Goldberg [10] et al, hyponatremia was present in 131 patients (12.5%) and hyponatremia developed in 208(19.9%) during the first 72 hours of hospitalization.Patients who presented or developed hyponatremia more often had lower ejection fraction. This is in accordance to the study conducted by Goldberg[10] et al.Alexander G. et al also found reduced left ventricular ejection fraction (42 ± 13%) among patients who developed hyponatremia after admission.Patients with hyponatremia had higher rates of in hospital and long term mortality.

In our study a total of 10 deaths (10%) occurred within 30 days of admission. 3.44% (2/58) of patients without hyponatremia, 24.1%(7/29) of patients with hyponatremia on admission, 7.69%(1/13) of patients who developed hyponatremia after admission.

In study done by Goldberg[10] et al, a total of 105 deaths (10%) occurred within 30 days of admission. 6.2% (44/708) of patients without hyponatremia, 19.8%(26/131) of patients with hyponatremia on admission and 16.8% (35/208) of patients who developed hyponatremia after admission. Klopotowski[11] et al,in their study of 1858 ST-elevation MI patients concluded that hyponatremia independently correlated with in-hospital mortality.

Bae[12] et al reported that in hospitalized survivors of acute myocardial infarction, the presence of hyponatremia at discharge was an independent predictor of 12-month mortality. The study involved 1290 patients.

In comparision with the above study, our study had higher mortality in patients with hyponatremia on admission whereas mortality was almost equal in patients who developed hyponatremia after admission.

In our study, odd‘s ratio for 30 day mortality in patients with hyponatremia on admission and patients who developed hyponatremia was high (3.143 and 12.0).This was in concordance with study done by Golderg[10] et al.

In our study, we found a trend of increasing mortality with the severity of hyponatremia. We stratified patients into two groups depending on the mean sodium level. The group with sodium level <130 mmol/L had 58% mortality and those with serum sodium in the range of 131-134mmol/L suffered 17% deaths. This was in accordance with the study conducted by Goldberg[10] et al., who showed increasing mortality with severity of hyponatremia.

When we compared the various risk factors and outcomes among the survivors and the non survivors, we found, apart from age, sex, ejection fraction, hyponatremia was significant risk factor in determining mortality. All the variables among the survivors and non survivors that were significantly associated with mortality were included in the multivariate logistic regression analysis. Hyponatremia remained a significant independent predictor ofmortality. This is in concordance to similar study conducted by Goldberg[10] et al., they found that hyponatremia was independently associated with 30 day mortality.Goldberg[10] et al, concluded in their study that the development ofhyponatremia is a marker that most likely incorporates different prognostic entities, including the severity of the left ventricular dysfunction, hemodynamic alterations and the extent of neurohumoral activation.

It was observed that the development of hyponatremia is a biochemical marker for prognostic importance i.e. left ventricular dysfunction severity, hemodynamical changes and neurohumoral activation.

Hence in our study, we concluded that hyponatremia on admission or early development of hyponatremia in patients with acue ST elevation MI is an independent predictor of 30 day mortality.

V. Conclusion

In our study we concluded that hyponatremia on admission or early development of hyponatremia in patients with acute ST elevation myocardial infarction is an independent predictor of 30-day mortality. Plasma sodium levels may serve as a simple marker to identify patients at risk.

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