Section: Cardiology

Original Research Article

HYPONATREMIA - A PREDICTOR OF SHORT-TERM MORTALITY IN ACUTE ST SEGMENT ELEVATION MYOCARDIAL INFARCTION (STEMI) IN A TERTIARY CARE CENTRE

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Abstract

Background: To study the short-term mortality in patients with ST segment elevation myocardial infarction (STEMI) with hyponatremia. **Materials and Methods:** 50 patients admitted to the intensive coronary care unit of Osmania Medical College hospital. After taking informed and written consent and after institutional and ethical committee approval all included eligible patients will be subjected to a detailed clinical history and clinical examinations and lab investigations as per proforma will be performed. 12 lead ECG was taken for all patients, Leads V3R, V4R was taken in patients with inferior wall myocardial infarction. **Result:** Most of the cases in our study were within the age range of 41 to 60. Maximum age was 80, minimum age was 29. The mean age was 51.46, with a standard deviation of 12.8. In our study, 80% of the participants were men and 20% were women. M:F-4:1. **Conclusion:** Hyponatremia at admission or an early onset of hyponatremia found to be a significant independent risk factor in predicting short-term mortality in acute myocardial infarction, in addition to other risk factors.

INTRODUCTION

Coronary artery disease is the leading cause of death Worldwide.[1] Worldwide, coronary artery disease caused 17.8 million fatalities in 2019.[2-4] with India accounting for 80% of these deaths. According to estimates, India will account for 60% of all heart disease cases worldwide.[5] Due to the high prevalence of risk factors including diabetes and hypertension, Indians are more likely than people in developed nations to acquire coronary artery disease at a younger age.[6,7]

The most frequent type of acute coronary event in the Indian population is ST segment elevation myocardial infarction, which accounts for 60.6% of all cases of acute coronary syndrome.[8] According to published clinical trials, the overall fatality rate for STEMI is between 4 and 7 percent or even lower. The situation in the real world, however, differs from this. This is due to the specially selected and low-risk subgroup representation of the patients who are enrolled in the randomized trials. Therefore, the outcomes of these trials are not applicable to 50% of patients in the clinical practice. A realistic view can be retrieved from registry data.

According to CREATE registry data, patients with both unstable angina and AMI had an in-hospital mortality rate of 7.9% and a 30-day mortality rate of roughly 8.6% in India. South Indian population hospital mortality rates after STEMI were 16.9%, according to research by V. Jacob Jose and Satya N. Gupta from Vellore (Tamil Nādu). In hospitalized patients, hyponatremia is a prevalent electrolyte disorder notably in those with heart failure, nephrotic syndrome, or cirrhosis. Hyponatremia has been demonstrated to be a predictor of cardiovascular mortality in individuals with heart failure. In fact, the neuro hormonal activity that follows an acute myocardial infarction resembles that which follows heart failure. Following a MI, hyponatremia is common, and clinical recovery is accompanied by an increase in plasma sodium concentration. The prognostic value of hyponatremia in the setting of an acute myocardial infarction is lacking, despite the fact that its prognostic value in chronic heart failure is well established. The purpose of this study was to evaluate the prognostic significance of hyponatremia in the context of acute ST elevation MI as well as the usefulness of hyponatremia in predicting the short-term survival.[9,10]

Aim of the Study

- To determine the prognostic importance of hyponatremia as an independent risk factor in predicting short term mortality
- To study the relationship between severity of hyponatremia and short-term mortality.

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- To find out the association between hyponatremia and other risk factors like ejection fraction, hypertension, diabetes, smoking, age, sex and type of infarction.

MATERIALS AND METHODS

50 patients admitted to the intensive coronary care unit of Osmania Medical College hospital between December 2020 and November 2022, with acute ST elevation myocardial infarction (STEMI) were studied in a prospective manner.

Inclusion Criteria

Patients with age above 18years, male or female, who presented within 12 hours of onset of symptoms, with electrocardiographic evidence of STEMI, elevated cardiac biomarkers and received thrombolytic therapy, were included in our study

Exclusion Criteria

- Patients with Unstable angina.
- People with previous history of arrhythmias.
- People with previous history of cardiomyopathy or heart failure.
- People with previous diuretic use.
- People with cirrhosis of liver, renal disease, hypothyroidism

Study End Points

The primary end point was mortality within 30 days after myocardial infarction. Mortality data after discharge but within 30 days of myocardial infarction were collected by telephone returned by patients' families or reviewing hospital records

Statistical Method

Odd's ratio, Confidence interval, Mean, standard deviation was calculated. Suitable parametric and non-parametric tests (Chi square test for non-continuous variables, Analysis of variance for continuous variables Z test), Univariate and multivariate logistic regression tests were used to determine the association between hyponatremia and 30-day mortality.

A probability value of <0.05 was considered statistically significant.

RESULTS

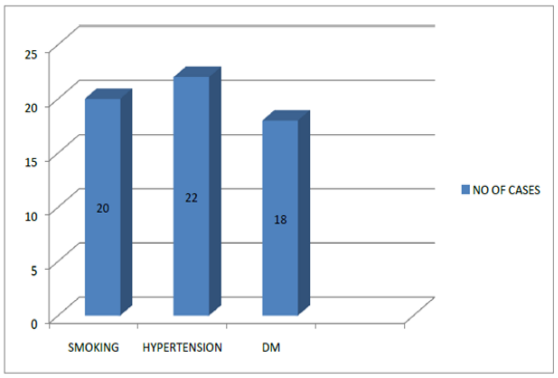

Figure 1: Showing Distribution of Risk Factors

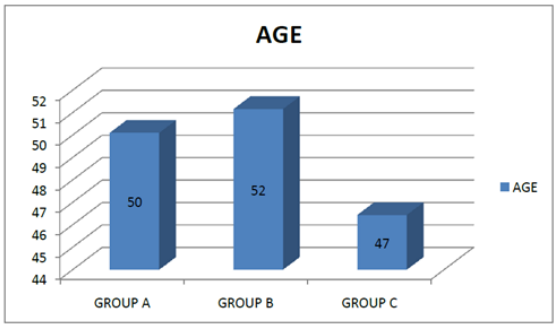

Figure 2: Mean age in Study Groups

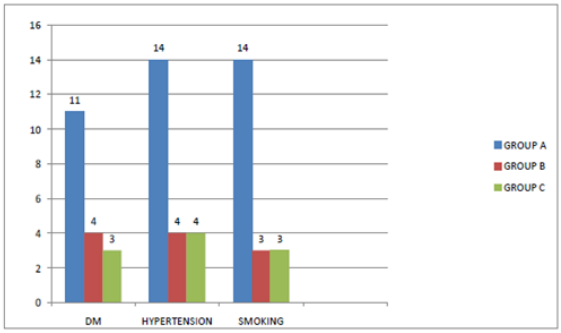

Figure 3: Risk Factors among the three groups

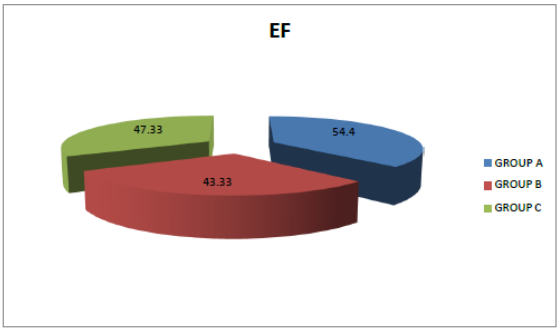

Figure 4: Ejection Fraction Among Three Groups

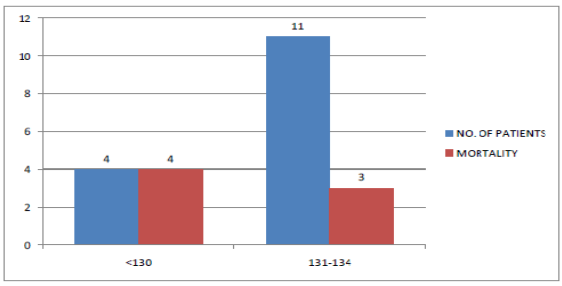

Figure 5: Severity of Hyponatremia and Outcome in terms of mortality

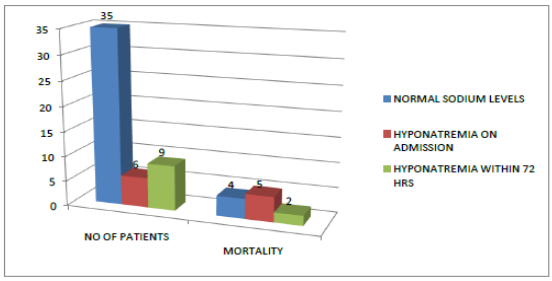

Figure 6: Mortality among three groups

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Table 1: Age Distribution of Cases.

Age	No. of cases	Percentage
21 – 30	2	4%
31 – 40	11	22%
41 – 50	12	24%
51 – 60	12	24%
61 – 70	11	22%
71 – 80	2	4%

Table 2: Showing Type of STEMI

S. No	Type	No. of Cases	Percentage	Death
1	AWMI	29	58%	7
2	ASMI	4	8%	0
3	ALMI	2	4%	1
4	IWMI	8	16%	2
5	IWMI + PWMI	5	10%	1
6	IWMI + RVMI	2	4%	0

Table 3: Total Cholesterol in Three groups

S. No	Contents	T.Ch < 200	T.CH 200-240	T.CH > 240
1	Total cases	23	17	10
2	Percentage	46%	34%	20%
3	Group A	18	15	5
4	Group B	3	1	2
5	Group C	2	2	3
6	Death	4	3	4

Table 4: Killip class among three groups

Killip Class	Normal sodium levels (n=35)	Hyponatremia on admission (N=6)	Hypnatremia within 72 hrs (N=9)	Death
Class I	28 (80%)	4 (66%)	7 (77%)	6 (54%)
Class II	6 (17%)	2 (33%)	1 (11%)	4 (36%)
Class III	1 (2%)	0	1 (11%)	1 (9%)
Class IV	0	0	0	0

Table 5: Severity of Hyponatremia and outcome in terms of mortality

Sodium levels	No. of cases	Mortality
< 130 MEQ/L	4	4 (100%)
131 – 134	11	3 (27.3%)

Table 6: Hospital and Post Discharge Death

S. No	No. of Days	No. of Deaths	Mean Sodium
1	< 7 Days	3	133.3 meq/L
2	8 – 30	8	134.4 meq/L

Table 7: SHOWING BASE LINE CHARACTERISTICS OF 50 PATIENTS

S. No	Characteristic	Normal Sodium levels (n=35)	Hyponatremia on admission (N=6)	Lyponatremia within 72 hrs	P value
1	Age	50 + 12	50 + 14	47 + 17	P=0.06
2	Male Sex	29 (82%)	4 (67%)	7 (78%)	P= 0.04
3	Diabetes	11 (31%)	4 (67%)	3 (33%)	P= 0.03
4	Smoking	14 (40%)	3 (50%)	3 (33%)	P=0.05
5	Hypertension	14 (40%)	4 (67%)	4 (44%)	P = 0.1
6	Anterior wall infarction	23 (66%)	4 (67%)	8 (89%)	P= 0.02
7	T. Cholesterol	208.7 + 29.78	212 + 30.1	212 + 33.4	P=0.6
8	S. IDL	114.5 + 20.8	121.5 + 31.3	122.4 + 29.4	P=0.3
9	Killip Class	Class I – 28 Class II – 6 Class III-1	Class I – 4 Class II – 2 Class III – 0	Class I – 7 Class II – 1 Class III – 1	P=0.001
10	Ejection fraction (%)	54.4 + 10.7	43.33 + 7.68	47.33 + 15.57	P=0.001

DISCUSSION

The emergence of hyponatremia in acute myocardial infarction is a sign that likely encompasses a number of prognostic factors, such as severe left ventricular failure, hemodynamic changes, and the degree of neurohormonal activation.

A total of 1047 patients with acute ST elevation MI and no prior history of cardiac failure were investigated by Goldberg A et al.[11]

It was found that short term mortality was independently correlated with hyponatremia at admission or early onset of hyponatremia.

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50 patients with acute ST elevation MI were included in our study. Mean age was 51.4 ±12.8. Most of the cases were in between the ages of 41 and 60. The mean age in the Aziz Met al12 trial was 57.28±6. The mean age in Goldberg's study was 61±12. It can be seen from other studies that Indians are more likely to develop MI at a younger age.

80% of the participants in our study were men, and 20% were women. Similar findings were found in research by Aziz M. et al,[12] and Goldberg A et al.[11] Thus, males are more prone to develop MI.

In our study, 20 participants were smokers, 22 had hypertension, and 18 had diabetes. 11 non-survivors included 72% smokers, 63% hypertensives, and 45% diabetics. According to Killip and Norris et al,[13] findings in the Framingham heart study, smoking and diabetes both increase the risk of myocardial infarction-related death. Out of 11483 hypertensive MI patients in the GISS-2 trial(69), 3306 individuals died. According to our study, smoking, diabetes, and hypertension are significant risk factors that affect mortality.

In our study, 6 patients (12%) had hyponatremia at the time of admission. patients (18%) had the onset of hyponatremia during the initial 72 hours of hospitalization. Hyponatremia was present in 131 patients (12.5%) and developed in 208 patients (19.9%) within the first 72 hours of hospitalization, according to a study by Goldberg A et al.[11] Studies by Flear CT et al,[14] Aziz M et al,[12] and Sushrat W et al,[15] found similar findings.

Our results were also consistent with other studies.

When compared to patients with normal sodium levels, who belonged to a younger age group (52 ± 12), patients who presented with hyponatremia on admission belonged to a higher age group (52 ± 14). In the study by Goldberg A, Hammerman H, et al,[11] patients with normal sodium levels had a mean age of 63±13, while those with hyponatremia had a mean age of 63±13.

The majority of the cases were involving males. 29 males (82%) had normal sodium levels, 4 had hyponatremia on admission (67%) and 7 (78%) developed it within 72 hours of admission. 6 females had normal sodium levels; 2 had hyponatremia at the time of admission, and 2 more developed it within 72 hours. The lower number of females in our study was the cause of the greater male ratio. Similar outcomes were discovered in the study by Goldberg A, Hammerman H et al, Aziz M et al.[11,12]

31% of individuals with normal sodium levels had diabetes,40 % were smokers, and 40 % had hypertension. Patients who were admitted with hyponatremia had a 67% had diabetes, 50% were smokers, and 67% had hypertension. Within 72 hours of admission, 33% of patients who had hyponatremia were diabetic, 33% were smokers, and 44% had hypertension. Thus, hyponatremia was more frequent in smokers, diabetics, and people with hypertension. This is consistent with research by Goldberg A, Hammerman H et al, Aziz M et al, and Hilis et al.[11,12,16]

54% of people had serum total cholesterol levels above 200 mg/dl. 8 patients in the hyponatremia group had total cholesterol levels above 200 mg/dl, while 5 patients had levels below 200 mg/dl.

LDL values were greater than 130 mg/dl in 7 patients with normal sodium levels, 2 patients who were admitted with hyponatremia, and 5 patients who developed it within 72 hours. Similar outcomes were discovered in the study by Goldberg A, Hammerman H et al, Aziz M et al.

Patients with normal sodium levels, those who had hyponatremia at the time of admission, and those who developed hyponatremia within 72 hours all had a higher incidence of anterior wall MI, which was 66%, 67%, and 89%, respectively. This was higher than golberg's study's findings, which were 37%, 49%, and 45%, respectively. Hyponatremia is a common complication of anterior wall infarction, according to study by Krumholz et al and Hillis et al.[17]

66% of patients with hyponatremia on admission belonged to Killip class I and 33 % belonged to Killip class II.77 % of patients who developed hyponatremia within 72 hours belonged to Killip Class I, whereas 11 percent belonged to Class II, and 11 percent to Class III. Our findings concurred with research by Hillis et al, Goldberg A et el.

When compared to patients with normal sodium levels (mean EF 54.4%), individuals who presented with hyponatremia (mean EF 43.33%) or acquired hyponatremia within 72 hours (mean EF 47.33%) had lower mean ejection fractions. Our findings were consistent with the study by Goldberg A, Hammerman H, et al., in which patients with normal sodium levels, hyponatremia upon admission, and hyponatremia within 72 hours had mean EFs of 47%, 42%, and 42%, respectively.

In our study, there was a 22% overall mortality rate. Patients with normal sodium levels had a mortality rate of 11%, while those with hyponatremia at admission had an 83% mortality rate and those with hyponatremia within 72 hours had a 22% mortality rate.

The overall mortality rate was 10% in the study conducted by Goldberg et al. In patients with normal sodium levels, the mortality rate was 6.2%. Mortality rates were 20% with hyponatremia at admission and 17% with hyponatremia within 72 hours. In contrast to above study, ours found that patients who had hyponatremia at the time of admission had a greater mortality rate, but patients who developed hyponatremia after admission had a mortality rate that was nearly similar.

The mortality rate was 100% in 4 patients with sodium levels below 130 meq/l. Mortality was 3/11 individuals, or 27%, with sodium levels between 131 and 134 meq/l. Our study's mortality rate was higher when compared to studies by Goldber A, Aziz M et al, and Rahman et al.

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According to our study, patients with hyponatremia who presented with it or developed it immediately after admission were males who were older, had a history of smoking, diabetes, hypertension, and anterior infarction, as well as a lower ejection fraction. This is consistent with research by Goldberg A, Hammerman H et al, and Aziz M et al.
Serum sodium levels were found to be statistically significant in predicting death. The mean serum sodium level among survivors was 135.02±1.65, while the lowest level was 133meq/l. The mean serum sodium level among those who did not survive was 130.9±2.7, while the lowest level was 127meq/l.
Hyponatremia on admission or the early onset of hyponatremia in patients with acute ST-Elevation MI found to be a strong independent predictor of short-term death, according to multivariate analysis.
As hyponatremia becomes more severe, the prognosis gets worse. Plasma sodium levels could be used as an early indicator of high-risk patients.

CONCLUSION

Hyponatremia on admission or early development of hyponatremia within 72 hours was associated with a poor prognostic outcome.
Severity of hyponatremia predicts mortality.

- (Sodium levels <130 meq/l was associated with 100% mortality when compared to levels between 131-134 meq/l which had a mortality rate of 27%)
- Males in the older age group, with poorer ejection fraction, anterior wall infarction, and a higher percentage of them being smokers, hypertensive, diabetic, and dyslipidemia patients were those who had hyponatremia on admission or who developed it within 72 hours.
- Hyponatremia at admission or an early onset of hyponatremia found to be a significant independent risk factor in predicting short-term mortality in acute myocardial infarction, in addition to other risk factors.
- Diabetes, dyslipidemia, smoking, and hypertension are the predominant risk factors for STEMI in Indians.
- Asians are more prone to develop STEMI at a younger age than western population.

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