e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(5); 1027-1033

Original Research Article

Serum Sodium Level as a Short Term Prognostic Indicator in Cases of Acute ST Elevation Myocardial Infarction in Southern Assam

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Received: 09-03-2023 / Revised: 30-03-2023 / Accepted: 30-04-2023

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Conflict of interest: Nil

Abstract

Background: The most common electrolyte anomaly in clinical practice is hyponatremia, which has a bad prognosis in ST elevation myocardial infarction (STEMI) and heart failure patients.

Objective: The present study aimed to study the Serum sodium level as an indicator of short term prognosis in cases of Acute ST Elevation Myocardial Infarction.

Methods: It was a hospital based prospective observational study conducted over a period of one year from June 2021 to May 2022 in Department of Medicine of a tertiary care teaching hospital in Assam, India in which 100 patients having acute ST elevation myocardial infarction based on diagnostic ECG changes were enrolled.

Results: Mortality among patients with normal sodium levels was 10.7 % while mortality in hyponatremia group was 27.3%. This association was statistically significant.

Conclusion: Serum sodium can be regarded as an inexpensive independent risk factor and prognostic marker of short term mortality in patients with ST elevation myocardial infarction.

Keywords: STEMI, Serum Sodium, Prognostic Marker, Mortality.

Introduction

One of the main causes of illness and mortality worldwide is coronary artery disease (CAD).[1,2] According to the WHO, heart attacks and strokes account for 85% of the estimated 32% of fatalities worldwide in 2019 from cardiovascular diseases, which cause more than 17.9 million deaths annually. More than 75 percent of these fatalities took place in developing and middle-income nations. 38% of the 17 million preventable deaths from non-communicable diseases (70 years) were attributable to cardiovascular disease.[3]

63% of all deaths in India in 2016 were attributed to noncommunicable diseases, of which 27% were related to cardiovascular disease. Cardiovascular illnesses are responsible for 45% of deaths in those between the ages of 40 and 69.[3]

According to studies done in both rural and urban India, the prevalence of CAD has increased over the past 30 years.[3] In its 16th

survey, the NSSO (National Sample Survey Office) examined 3,90,313 respondents for the prevalence of CAD and discovered that it was 7% in the urban population and 3% in the rural population.[4] The most prevalent electrolyte in plasma is sodium. Modern intensive care units frequently accept patients with abnormal serum sodium levels.[1] Patients with acute cardiac illness are more likely to have abnormal admission sodium levels, which is associated with greater mortality.[5] Heart failure (HF) is the greatest risk factor for cardiovascular mortality in cases of HF.

Hyponatremia, the most prevalent electrolyte aberration in clinical practise, has a poor prognosis in patients with ST elevation myocardial infarction (STEMI) and heart failure.[6] It increases short- and long-term mortality as well as hospital readmission rates, average length of stay, and mortality overall.[7] HF also exhibits hyponatremia, which is most typically seen after myocardial infarction and is caused by neurohumoral activation.[8] According to certain studies, like that of Goldberg *et al*, hyponatremia at the time of admission or soon after is a reliable indicator of both short- and long-term mortality in STEMI.[9]

I have made an effort to determine whether serum sodium may be utilised as an indication of short term prognosis in STEMI and to assess serum sodium levels in patients with STEMI because such studies have not been made in this area of southern Assam.

Material and Methods

Study design, settings and participants:

It was a hospital based prospective observational study conducted over a period of one year from June 2021 to May 2022 in Department of Medicine & department of cardiology of a tertiary care teaching hospital in Assam, India. 100 patients having acute ST elevation myocardial infarction based on diagnostic ECG changes as with characteristic ECG alterations consisting a) New ST-segment elevation at the J point in 2 contiguous leads with the cutoff point as greater than 0.1 mV in all leads other than V2 or V3 or b) in leads V2-V3 the cutoff point is greater than 0.2 mV in men older than 40 years old and greater than 0.25 in men younger than 40 years old, or greater than 0.15 mV in women.[10] Patients with a pre-existing left bundle branch block were further evaluated using Sgarbossa's criteria.[10,11] Patient with acute coronary syndrome without ST elevation, with duration of chest pain for more than 3 days(72hrs), renal failure patient and chronic liver disease patient were excluded from the study.

Data collection

After acceptance of the protocol by the ethics committee an informed consent was obtained from those patients diagnosed as acute ST elevation myocardial infarction presenting in the casualty of Medicine and Cardiology OPD of Silchar Medical College and Hospital who fulfilled the criteria of inclusion and exclusion.

All subjects were interviewed as per the prepared proforma and then complete clinical examination was done. Patients' detailed history and clinical examination was done. Serum sodium concentration were measured on admission and at 24, 48 and 72 hours.

Estimation of serum sodium

The blood samples of the patients were drawn from the antecubital vein using a 5 ml syringe and immediately mixed in RED vacutainers. Serum sodium was analysed by the VITROS 5600 integrated system.

Principal of the procedure

The VITROS Na+ Slide is a multilayered, analytical element coated on a polyester support that uses direct potentiometry for Na ion measurements. The slide has two ion

selective electrodes, each containing methy monensin, a reference layer, a silver layer and a silver chloride layer coated on a polyster support. When a drop of vitros reference fluid and a drop of patient sample are placed on opposite halves of the slide, both fluids move toward the center of the paper bridge. A stable liquid junction is formed that connects the reference electrode to sample electrode. Each electrode generates an electrochemical potential in response to sodium activity, and the difference between the potentials of the two electrodes is proportional to the amount of sodium present in the sample.

Other investigations like cardiac biomarkers, renal function test, liver function test, complete blood count, random blood sugar and Echocardiography was also done.

Data entry and statistical analysis

The collected data were transformed into variables, coded and entered in Microsoft Excel. Data were analyzed and statistically evaluated using SPSS-PC-25 version.

Normal distribution of different parameters was tested by the Shapiro-Wilk normality test. Quantitative data was expressed in mean ± standard deviation or median with interquartile range and depends on normality difference between mean of two groups were compared by student t test or Mann Whiney U test while Qualitative data were expressed in frequency and percentage and statistical differences between the proportions were tested by chi square test or Fisher's exact test. P' value less than 0.05 was considered statistically significant.

Ethical issues

All participants were explained about the purpose of the study. Confidentiality was assured to them. Informed written consent was taken from them or their parents or caregivers. The study was approved by the Institutional Ethical Committee.

Observation & Results

The distribution of age in study subjects ranges from 24 to 90 years. In these STEMI patients, majority of them were in 51-60 years of age group (32%), followed by 61- 70 years of age group (26%). The mean age of study participants were 59.02 ± 12.0 years. 75% of patients were males and 25% were females. (table 1) Anterior wall (46%) MI was most common type followed closely by Inferior wall (32%) (figure 1). Killip class I is found in 44 (44%) patients, class II is seen in 33(33%) patients, class III is seen in 17(17%) and class IV only seen in 6(6%) patients. In this study of 100 subjects, 44 were found to have low serum sodium levels while 56 were found to have normal serum sodium level. Mortality rate was 18% in our study.

Table 1: Baseline characteristics of MI study subjects (n=100)

Age group	No.	%
Age group		
Upto 40 years	8	7.0
41-50 years	17	17.0
51-60 years	32	32.0
61-70 years	26	26.0
71-80 years	12	12.0
>80 years	5	5.0
Gender		
Male	75	75.0
Female	25	25.0
Comorbidities		

DM	26	26.0
Hypertension	46	46.0

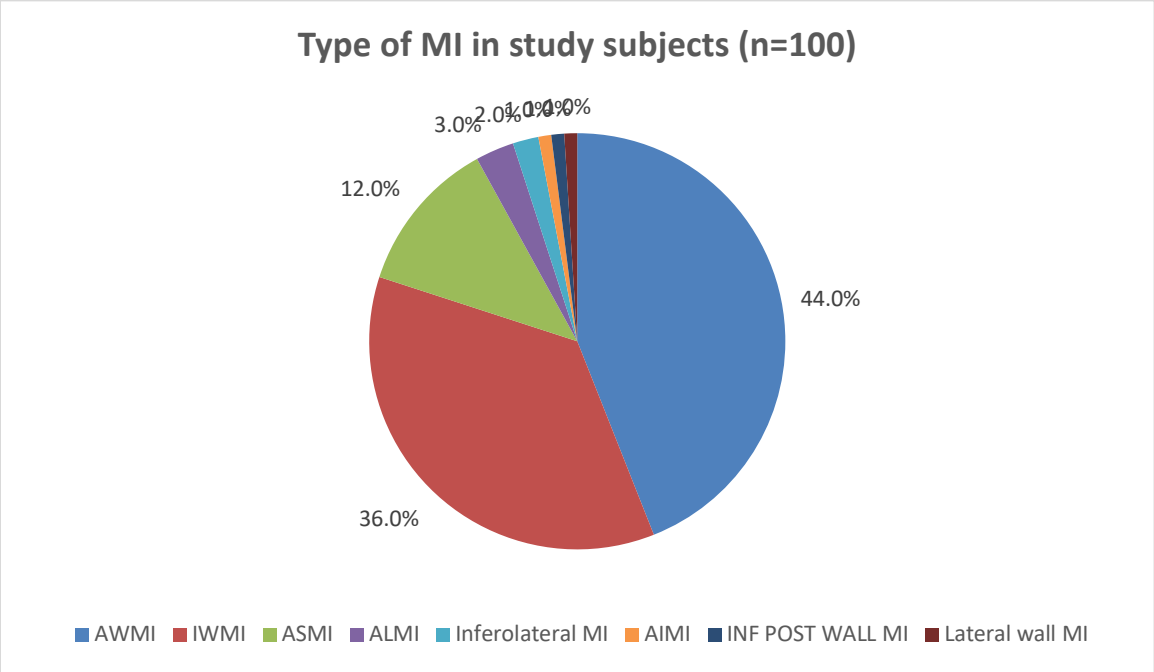

Figure 1: Type of MI in study subjects (n=100)

The Ejection Fraction was lower among patients who presented with hyponatremia/developed hyponatremia within 72 hrs (48.16±12.18) compared to patients with normal sodium levels (54.43±6.17) and it was found to be statistically significant (p<0.0001).

Table 2: Comparison of Ejection fraction and cardiac markers between low and normal Na level in study subjects (n=100)

	Na <135 (n=44)	Na ≥135 (n=56)	P value
Ejection Fraction (%)	48.16±12.18	54.43±6.17	**<0.001**

The overall mortality rate in our study was 18 of the 100 patients (18%). Mortality among patients with normal sodium levels was 10.7 %, mortality in hyponatremia group was 27.3%. This association was statistically significant (table 3).

Table 3: Outcome according to Na level in study subjects (n=100)

Outcome	Na <135 (n=44)	Na ≥135 (n=56)	P value
Expired	12 (27.3%)	6 (10.7%)	**0.03**
Survived	32 (72.7%)	50 (89.3%)	

Discussion

In our study the distribution of age in STEMI patients ranges from 24 to 90 years. In these STEMI patients majority of them were in 51-60 years of age group (32%), followed by 61-70 years of age group (26%). The mean age of study participants were 59.02 ± 12.0 years.

In the present study, STEMI was found more commonly among male patients than among female patients. These findings correlate well with the study done by Goldberg *et al*[12] and Lazzeri C *et al*.[13]

In this investigation, we discovered that patients who arrived with hyponatremia had lower mean ejection fractions than patients with normal sodium levels (mean EF 54.436.17), which was statistically significant (p <0.001). These results are consistent with a research by Goldberg A *et al*.[12], in which the mean EF was 47%, 42%, and 42%, respectively, in patients with normal sodium levels, hyponatremia at admission, and hyponatremia within 72 hours. Similar to this, a study by Lazzeri C *et al*.[13] found that the incidence of hyponatremia was higher in patients with admission LVEFs below 45% than it was in patients with admission LVEFs over 45% (p = 0.002).

Our study's overall mortality rate was 18 (18%). Hyponatremia caused 12 (27.3%) patients to die, compared to 6 (10.7%) patients with normal salt levels, which is statistically significant (p=0.03). The mortality rate in the Goldberg *et al*. study[12] was 10%. Normonatremic patients had a mortality rate of 6.2%, whereas hyponatremia patients had a mortality rate of 19.8% upon admission and a mortality rate of 16.8% following admission. A higher fatality rate was observed in the hyponatremia group in the study by Havránek *et al*. [14]: 25 (34.7%) compared to the normonatremic group: 30 (20.5%), Patients who had hyponatremia at the time of admission accounted for a total of 18 (35.3%) deaths, and patients who developed hyponatremia while being treated in the hospital accounted for 7 (33.3%) deaths. (p = 0.02), which is also consistent with the results of our investigation. Another study by Tang *et al*.[15] revealed that 212 (13.1%) out of 1,620 patients had hyponatremia (sodium 135 mmol/L) at the time of presentation. In-hospital mortality was greater in patients with hyponatremia (13.7% vs. 7.3%, p=0.002).

Our study had a greater death rate when compared to studies by Goldberg A *et al*[12] and Havránek *et al*[14]. According to the results of our study, STEMI patients with hyponatremia were more likely to be men, diabetics, or hypertensives. They also had lower ejection fractions and anterior infarctions. This is consistent with research by Goldberg A. *et al* [12], Tada *et al*[16], and Lazzeri C. *et al*.[13] We also understood that the statistical significance of serum sodium levels in predicting mortality. However, there were 4 hyponatremic individuals who passed away with sodium levels >130mEq/L (between 130-35mEq/L). While there were a total of 6 individuals who passed away in the group with normal sodium levels. This demonstrates that the prognosis was worse the more severe the hyponatremia. Thus, sodium can be used as an independent marker and predictor of morbidity and mortality.

Conclusion

Finally, it can be inferred from this study that serum sodium can be regarded as an inexpensive independent risk factor and prognostic marker of short term mortality in patients with ST elevation myocardial infarction.

The result of this study is in agreement with other national and international studies. It is hoped that the present study will encourage new studies related to the above subject with a broader spectrum and for longer durations.

Recommendations

Although, conduction of this study in a sole institution with paucity of time and resources highlighted the role of serum sodium levels in influencing the course of STEMI, a more elaborate multi-centre study for a longer duration covering a relatively wider geographical area, consisting of a larger sample size, and representing different ethnic groups would be needed to precisely establish the role of serum sodium level in STEMI.

Acknowledgement

The authors are grateful to all the participants for their support and contribution.

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