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Original Article

A Prospective study comparing the frequency of hyponatremia in survivors and deaths after ST elevation myocardial infarction- A cohort study.

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Abstract

Background
With differing results both in the hospital and subsequently, STEMI remains a serious health issue. At the community level, effective interventions are required to stop its progression. One of the major issues with CVDs in India is hypertensive heart disease. In order to address this substantial burden, it is necessary to comprehend the intricate dynamics that underlie the connections between the biological and social determinants.

Objectives- To compare the incidence of hyponatremia among survivors and deaths after ST elevation MI, the current study was conducted.

Materials and methods
It was a prospective, observational study. The study was carried out at the Department of Emergency and Cardiology, Kerala Institute of Medical Sciences (KIMS), Trivandrum, Kerala, India. The study was conducted for 18 months, that is, from November 2018 to February 2020. In all, 100 patients were enrolled in the study.

Results
34% of the patients were between the ages of 51 and 60, and 38% were between the ages of 61 and 70. The bulk of the patients were in this age range. With 80% of the patients being men and only 20% being women, there was a pronounced male predominance. The most common comorbidities were diabetes mellitus (57%) and hypertension (61%), indicating their close correlation with STEMI.

Conclusion
According to the study's findings, patients with STEMI who had hyponatremia had a considerably higher in-hospital death rate. According to the study's findings, serum sodium levels in STEMI patients should be regularly checked since they can be a straightforward and affordable prognostic indicator.

Recommendation
Regular monitoring of serum sodium levels is recommended in STEMI patients to identify and manage the risk of in-hospital mortality.

Keywords: *ST-Elevation Myocardial Infarction, Hyponatremia, Survivors, Cardiovascular Disease, Myocardial Infarction*
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Introduction

In the general population, cardiovascular disease (CVD), particularly acute coronary syndromes (ACS), is prevalent and primarily affects persons over 60 years. Deaths from lifestyle diseases are on the rise these days, and ACS is a common one. The three symptoms of ACS are acute ST elevation myocardial infarction (STEMI), acute non-ST elevation myocardial infarction (NSTEMI), and unstable angina (UA). It affects people physically, financially, and psychologically [1]. In recent years, MI cases have sharply increased in developing nations like India [2].

With differing results both in the hospital and subsequently, STEMI remains a serious health issue. At the community level, effective interventions are required to stop its progression. Biological processes, societal variables, and their interplay mainly results in fatality rates , mortality in premature, and further they can develop CVD.

One of the major issues with CVDs in India is hypertensive heart disease. In order to address this substantial burden, it is necessary to comprehend the intricate dynamics that underlie the connections between the biological and social determinants. In India, the epidemiological landscape has changed dramatically during the past 20 years. In a short period of time, infectious diseases, undernutrition-related illnesses, and maternal and pediatric illnesses have given way to non-communicable diseases as the main epidemiological features [3].

As a sign of these hormonal shifts, hyponatremia could be a quick, accessible, and affordable way to identify people who are at risk [4]. It is crucial to determine the incidence of hyponatremia in MI since it is a clinically helpful indicator of the severity of an acute myocardial infarction. Hyponatremia has been reported to be further correlated in individuals with STEMI and NSTEMI, according to a small number of studies.

Serum sodium levels in STEMI patients upon hospital admission, 24 hours, 48 hours, and 72 hours later have been the basis of several studies. The Indian population lacks information on the prevalence of hyponatremia and its significance as a prognostic factor in the early stages of STEMI. In order to compare the incidence of hyponatremia among survivors and deaths after ST elevation MI, the current study was conducted.

Methodology

Study setting

The study was conducted at the Department of Emergency and Cardiology, Kerala Institute of Medical Sciences (KIMS), Trivandrum, Kerala, India, a tertiary care center with specialized facilities for cardiovascular care. The study was conducted over a period of 18 months, from November 2018 to February 2020.

Methods and procedures for collecting and analyzing data

This was a prospective observational study designed to compare the incidence of hyponatremia among survivors and deaths after ST-Elevation Myocardial Infarction (STEMI). The study involved the systematic collection and analysis of clinical, laboratory, and demographic data of eligible patients.

Study population

In all, 100 patients were enrolled in the study. Participants had to meet the following requirements to be enrolled such as in more than two contagious leads of more than 0.1 mV, elevation at ST point among leads in men who are aged more than 40 years, and substantially in women the elevation is of 0.15 mV, participants with either new or presumed new LBBB, and participants who were study-willing. Patients with acute MI and heart failure, those taking diuretics, and those with acute coronary syndrome without ST elevation were all excluded from the study.

Sample size

A sample size of 100 was chosen for this study based on feasibility within the available study period, hospital admission rates, and the need for adequate power to detect significant differences between survivors and non-survivors with STEMI, particularly about serum sodium levels. However, no formal sample size calculation was reported.

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Bias

Efforts were made to minimize selection bias by consecutively enrolling eligible patients admitted during the study period. Information bias was reduced through standardized data collection protocols, and laboratory measurements were performed using validated instruments in a NABL-accredited laboratory.

Data collection

Clinical history, sociodemographic information, and specifics regarding CAD risk factors were gathered. Vital signs, a 12-lead ECG, a general examination, and a systemic examination that included a thorough analysis of the cardiovascular system were all part of the clinical examination.

Study procedure

Before starting treatment, venous blood samples were taken at the time of admission. Serum sodium levels in these ill patients are routinely checked every day. The NABL-accredited laboratory at KIMS, Trivandrum, used the COBAS ISE 8000 and COBAS 502 indirect methods to measure the serum salt levels.

Statistical analysis

Data were initially entered in Microsoft Excel. The data has been presented as the number of participants (n) and percentages (%). The statistical program SPSS version 16.0 was used to analyze all of the data once it was imported into Microsoft Excel. Statistical significance is defined as a p-value of less than 0.05.

Ethical clearance

The study was approved by the Institutional Ethics Committee of Kerala Institute of Medical Sciences (KIMS), Trivandrum.

Results

A total of 125 patients were initially assessed for eligibility during the study period. Among them, 15 patients were excluded based on exclusion criteria, such as presence of heart failure, use of diuretics, or absence of ST-segment elevation. Additionally, 10 patients either declined to participate or withdrew consent. Ultimately, 100 patients were confirmed eligible and enrolled in the study.

A total of 125 patients were screened for eligibility before enrolling the final 100 participants. 34% of the patients were between the ages of 51 and 60, and 38% were between the ages of 61 and 70. The bulk of the patients were in this age range. With 80% of the patients being men and only 20% being women, there was a pronounced male predominance. The most common comorbidities were diabetes mellitus (57%) and hypertension (61%), indicating their close correlation with STEMI. The study participants' demographics are shown in Table 1.

Table 1. Demographics of study participants

Parameter	Frequency (n)	Percentage (%)
Age Group		
< 40 years	02	2%
41–50 years	13	13%
51-60 years	34	34%
61-70 years	38	38%
> 60 years	13	13%
Gender		
Male	80	80%
Female	20	20%
Risk Factors		
Hypertension	61	61%

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Diabetes Mellitus	57	57%
Smoking	35	35%
Family History of CAD	07	7%

6 patients (66.7%) expired, and only 17 patients (18.7%) survived among those with hyponatremia. Of these, just three patients (33.3%) expired, while 74 patients (81.3%) survived. There is a statistically significant correlation between hyponatremia and higher mortality in STEMI patients, as indicated by the p-value = 0.004, which is less than 0.05. Table 2 shows the relationship between serum sodium and the result.

Table 2. Levels of serum sodium with outcomes of survival

Serum Sodium Level	Survived	Expired	p-value
Hyponatremia	17 (18.7%)	6 (66.7%)	**0.004***
Normal Sodium	74 (81.3%)	3 (33.3%)	
Total	91 (100%)	9 (100%)	

Discussion

The frequency of hyponatremia in STEMI patients and its correlation with in-hospital mortality were assessed in this prospective observational study. The results of this study show a strong association between poor outcomes and hyponatremia.

Patients in hospitals frequently have abnormalities of their Na+ homeostasis. There is a change in Na+ homeostasis in acute STEMI. The relationship between serum Na+ levels and mortality has been the subject of numerous investigations. A tertiary care hospital's 100 patients participated in this study. In contrast to studies by Devi et al., Singh et al., and Plakht et al., where 64.8%, 80%, and 65% of the patients, respectively, were male, our study had 80% of the patients be male. 38% of the study's patients were between the ages of 61 and 70. The study conducted by Devi et al., Singh et al., and Plakht et al. is nearly identical [4, 5, 6]. The prevalence of hyponatremia was found to be considerably higher in older age groups.

In terms of STEMI risk factors, diabetes mellitus was present in 57% of the research participants. It is somewhat comparable to a study by Plakht et al. in which diabetes mellitus affected 44% of the participants. Diabetes mellitus was found to be less common in STEMI in other investigations conducted by Singh et al., Nguyen et al. and Kurian et al. [5, 6, 7].

The percentage of those with a prior history of CAD is only 7%. In other investigations, Rodrigues et al. and El-Menyar et al. discovered that 29% and 26% of their study group, respectively, had a history of CAD [8, 9].

The incidence was decreased in the group of survivors. Hyponatremia affected 24% of the survivor group, which is comparable to the 25% seen in the Singh et al. study. Devi et al. found that the survivor group had a greater frequency of hyponatremia (41%). This study discovered a strong correlation between hyponatremia and survivability in STEMI. Studies like Goldberg et al., Plakht et al., Devi et al., and others support this [4, 10, 11].

A common electrolyte imbalance that is acquired in hospitals, hyponatremia is frequently linked to high rates of death and morbidity as a result of the development of serious underlying conditions. According to this research, hyponatremia upon admission and hyponatremia that develops after admission are still reliable predictors of survival in STEMI. Goldberg et al. conducted large sample size studies that demonstrated a substantial correlation between hyponatremia and mortality.

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Generalizability

The study findings are applicable to STEMI patients in tertiary care centers, particularly in settings with high rates of hypertension and diabetes. Caution is advised when applying these results to community or primary care populations.

Conclusion

According to the study's findings, patients with STEMI who had hyponatremia had a considerably higher in-hospital death rate. According to the study's findings, serum sodium levels in STEMI patients should be regularly checked since they can be a straightforward and affordable prognostic indication. More intensive clinical surveillance and treatment action may result from early detection of hyponatremia, which could enhance patient outcomes.

Limitations

Since this study was conducted in a single urban tertiary care facility, it may not be feasible to extrapolate the findings to the broader population. Additionally, the study's sample size was too small to draw conclusions and extrapolate findings.

Recommendations

As this was a short-term study, further research is needed with a longitudinal study design and a larger sample to achieve more definitive results.

Source of funding

The study received no external funding and was conducted as part of institutional clinical research at KIMS, Trivandrum.

List of abbreviations

STEMI- ST-Elevation Myocardial Infarction
MI- Myocardial Infarction
KIMS- Kerala Institute of Medical Sciences
ECG- Electrocardiogram
CAD- Coronary Artery Disease
NSTEMI- non-ST elevation myocardial infarction
CVD- Cardiovascular disease
ACS- Acute coronary syndrome
UA- Unstable angina
ISE: Ion-Selective Electrode
ST: ST Segment.

Data availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Author contributions

All authors contributed to the study's conception, design, data collection, analysis, and manuscript preparation. All authors read and approved the final manuscript.

Author biography

The authors are affiliated with Kerala Institute of Medical Sciences, Trivandrum, with expertise in cardiology, emergency medicine, and clinical research, focusing on cardiovascular risk and outcomes.

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