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# STUDY OF HYPONATREMIA IN PATIENTS WITH ST ELEVATED MYOCARDIAL INFARCTION IN A TERTIARY CARE CENTRE

General Medicine

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## ABSTRACT

**Background:** Hyponatremia is a prevalent electrolyte condition in clinical settings and among hospitalized patients. After a myocardial infarction (MI), hyponatremia is typical, and clinical recovery is accompanied by an increase in plasma sodium concentration. Neurohormonal activation leads to hyponatremia in acute ST-elevation myocardial infarction (STEMI). The severity of cardiac injury is correlated with the extent of this neurohormonal changes. In patients with acute coronary syndrome, hyponatremia has a considerable predictive value for both short- and long-term adverse outcomes. Therefore, identifying and risk stratifying for optimal management may be aided by the continuous assessment of serum sodium levels. **Aim:** To study the effect of hyponatremia in acute myocardial infarction and to study the association between hyponatremia and ejection fraction, ST elevation and the outcome in myocardial infarction. **Materials and Method:** The present study was a cross sectional study conducted in Department of General Medicine, Sree Mookambika Institute of Medical Sciences for a period of 6 months from January 2023 to June 2023. A total of 95 patients of both genders presented with acute ST segment myocardial infarction during the study period were enrolled in this study. Blood samples were taken from all the patients to examine the serum sodium level at admission and at 48 hours. Hyponatremia was defined as serum sodium level <135 mmol/L. Results were analyzed using SPSS 20.0 version and the association was tested using Chi square test. **Results:** The most common age group in the present study was 61 to 70 years seen in 28(29.47%) patients. The mean age group in the study population was 62±5.8 years. Hyponatremia was observed in 37(38.95%) of the patients. Hyponatremia was associated with higher age group (p=0.018), site of MI (p=0.001) and Killip class (p <0.0001). The Ejection Fraction was lower among patients presented with hyponatremia when compared with patients with normal sodium levels (44.71 vs 54.35) (p<0.0001). The mean ST elevation in hyponatremia was higher (4.7±1.8) that patients without hyponatremia (3.4±2.1) and had a p value of 0.002. The mortality was found among 5(13.51%) and frequency of acute heart failure was found in 17 (45.95%). **Conclusion:** Hyponatremia is frequent in individuals with acute MI and is associated with an increased risk of death during hospitalisation as well as an increased risk of complications such as heart failure. Plasma sodium concentrations is an easy diagnostic to spot patients who are at risk.

## KEYWORDS

Acute myocardial infarction, Heart Failure, Hyponatremia, Prognosis, ST segment

## INTRODUCTION:

Coronary heart disease(CHD) is a leading cause of death and a global public health issue that has pandemic levels in both industrialized and developing nations. It has been found that it can affect individuals of all ages and can have serious negative, psychological, and economic consequences.[1] One of the manifestations of acute coronary syndromes(ACS) is ST-segment elevation myocardial infarction (STEMI). In the industrialized world, STEMI is still a significant health issue, and it is getting worse in developing nations.[2]

Hormones such as norepinephrine, renin, and vasopressin are released as a result of neurohormonal activation in STEMI.[3] Hyponatremia is a result of these hormonal alterations. Antidiuretic hormone (ADH) may be released in excess in STEMI due to the stress response as well as pain during the heart attack. This in turn cause the kidneys to retain more water and the blood to become less concentrated in sodium.[3,4]

The cardiac muscle may suffer severe damage as a result of STEMI, which could cause pump failure. Heart failure (HF) may significantly decrease the capacity of the blood to pump. When the heart fails to efficiently pump blood, the kidneys may respond by holding more salt and water, eventually decreasing the level of sodium in the blood.[5,6]

The most common electrolyte anomaly in clinical practise is hyponatremia, which has an adverse outcome in both STEMI as well as HF patients.[7] A serum sodium level of less than 135mEq/L is considered hyponatremia. Hyponatremia was classified as mild (131-135mEq/L), moderate (125-130mEq/L), and severe (125mmol/L) depending on its severity.[8]

The average duration of stay in the hospital, rehospitalisation rates, and short- and long-term mortality are all made worse by hyponatremia. One thing is certain: earlier identification of people at risk for developing hyponatremia could aid in the start of early treatment. It is yet unknown if hyponatremia is simply a marker of unwell patients or the root of the poor prognosis in patients suffering from STEMI and HF.[7,8]

Patients who experienced hyponatremia during an acute STEMI were found to be more likely to experience acute heart failure. As a result, in the acute phase of STEMI, it has been demonstrated to be an indicator of both long- and short-term mortality, acute and chronic HF along with re-hospitalization. In patients with STEMI, hyponatremia was independently associated with HF and in-hospital mortality.[9]

There is no reliable information on the prevalence of hyponatremia among STEMI patients whom have received local therapy. This study will help us understand the scope of the problem in the local community, as well as its clinical ramifications in terms of mortality and acute HF in hyponatremia patients.

## MATERIALS AND METHODS:

The present study was a cross sectional study conducted in Department of General Medicine, Sree Mookambika Institute of Medical Sciences, Kulasekharam for a period of 6 months from January 2023 to June 2023. A total of 95 patients of both genders presented with acute ST segment myocardial infarction during the study period were enrolled in this study.

Patients' detailed information were collected, including age, gender, and co-morbidities including hypertension, diabetes, smoking, and obesity. All patients with a confirmed diagnosis of acute STEMI, defined as retrosternal compressive chest pain lasting longer than 30 minutes and not alleviated by rest or nitrates, new electrocardiographic changes indicative of acute STEMI such as ST elevation of greater than 0.1mv in all leads (with two contiguous leads) with the exception of V2-V3, where ST elevation is greater than 0.2mv, and development of ST segment elevation and development of pathological Q waves, Detection of elevation of cardiac troponin levels > 0.04, and who were willing to participate in the study were included. Patients with chronic liver diseases, acute renal failure, congestive heart failure and those who are not willing to participate in the study were excluded.

At the time of presentation, Killip classifications were determined for each patient. The highest ST segment elevation was measured in millimeters on each patient's ECG. All of the patients had blood drawn

in order to check their serum sodium levels upon admission and after 48 hours. Utilizing an automated analyzer, sodium levels were evaluated. A serum sodium concentration below 135 mmol/L was considered hyponatremia.

Data entered in Excel sheet. Statistical Analysis was carried out using SPSS 20.0 version. The mean and standard deviation were calculated. The frequencies and percentages were recorded. Chi square test/ Fishers extract test was used for comparison analysis. A p value less that 0.05 was considered statistically significant.

## OBSERVATION AND RESULTS:

The present study included 95 patients of STEMI. Hyponatremia was observed in 37(38.95%) of the patients. The most common age group in the present study was 61 to 70 years seen in 28(29.47%) patients with the age ranged from 44 to 79 years. The mean age group in the study population was 62±5.8 years. Hyponatremia was most commonly associated among patients with age more than 61 years and when compared to age groups showed statistical significance (p=0.018).

In the present study males were commonly affected that the females, 63(66.32%) and 32(33.68%) respectively. Among the 37 patients with hyponatremia, 19(51.35%) were males and 18(48.64%) were females. (p=0.32)

Among the study population, hypertension 69(72.63%) and diabetes 54(56.84%) were the most common comorbidities associated and hyponatremia was seen in 23(33.33%) of hypertensive patients and 16(29.63%) of diabetic patients with p value of 0.82 and 0.063 respectively. Of the 95 patients, 59(62.11%) patients were smokers and hyponatremia was present in 39(66.1%) patients with a p value of 0.04, which was considered statistically significant.

Hyponatremia was commonly associated with inferior wall followed by Anterolateral wall when compared to other sites and on comparison the study found statistical significant association between sites of MI and hyponatremia. (Table 1) All the patients in Killip class III and IV had hyponatremia than other classes and that showed statistical significance as shown in table 4.

**Table 1: Comparison of sites of MI with hyponatremia**

| Site of MI | Hyponatremia | | p value |
|---|---|---|---|
| | Present (n=37) | Absent (n=58) | |
| Anterior wall | 6 (16.22%) | 22(37.93%) | 0.001 |
| Anterolateral wall | 10(27.02%) | 7(12.07%) | |
| Anteroseptal wall | 2(5.41%) | 0(0%) | |
| Inferior wall | 19(51.35%) | 29(50%) | |

**Table 2: Comparison of Killip class with hyponatremia**

| Killip class | Hyponatremia | | p value |
|---|---|---|---|
| | Present (n=37) | Absent (n=58) | |
| I | 11(29.23%) | 49(84.48%) | <0.0001 |
| II | 15(40.54%) | 9(15.52%) | |
| III | 6(16.22%) | 0 | |
| IV | 5(13.51%) | 0 | |

The Ejection Fraction was lower among patients presented with hyponatremia when compared with patients with normal sodium levels (44.71 vs 54.35) which was found to be significant (p<0.0001). The mean degree of ST elevation in hyponatremia was higher (4.7±1.8) that patients without hyponatremia (3.4±2.1) and had a p value of 0.002. Among the 37 hyponatremic patients, mortality was found among 5(13.51%) and frequency of acute heart failure was found in 17 (45.95%).

## DISCUSSION:

The leading cause of death worldwide is infarction, which frequently results in medical emergencies. Poor outcomes in those with acute and chronic cardiac conditions such left ventricular HF and acute MI have been associated with hyponatremia. Patients with HF have a significantly worse prognosis when they have hyponatremia.[10] However, there are currently few data on its significance in myocardial infarction patients.

Complex neuro-hormonal activation, including non-osmotic vasopressin release, sympathetic nervous system activation, and renin-angiotensin activating system activation, occurs after acute myocardial infraction. Hyponatremia and its intricate neurohormonal activation are related. The severity of cardiac injury, which is represented in the severity of hyponatremia, is correlated with the extent of the neuro hormonal shift.[11] Numerous studies conducted in the past have shown that electrolyte imbalances like hyponatremia are strongly linked to poor outcomes among individuals with STEMI.

In the current study, 28 patients (29.47%) ranging in age from 44 to 79 years with the most prevalent age group being 61 to 70 years. In the study population, the average age was 62±5.8 years. Females 32(33.68%) were more frequently affected than males 63(66.32%). In the 125 patients studied by Shahid MA et al.[12] 75 (60%) were men and 50 (40%) were women, with a mean age of 53.8±11.61 years.

Comparison of frequency of hyponatremia with other studies was given in table 3.

**Table 3: Comparison of frequency of hyponatremia with other studies**

| Studies | Frequency of hyponatremia |
|---|---|
| Shahid MA et al.12 | 52 (40%) |
| Khan AW et al.13 | 58(35.15%) |
| Devi KB et al.14 | 44(44%) |
| Jamil M et al.15 | 35 (22%) |
| Present study | 37(38.95%) |

Hyponatremia was most commonly associated among patients with age more than 61 years and when compared to age groups showed statistical significance (p=0.018). Of the 37 hyponatremia patients, 19 (51.35%) were men and 18 (48.64%) were women. In the study by Khan AW et al.[13] there were 103 (62.42%) male participants and 37.58 % female participants, with a mean age of 56.14 ±10.46 years. BMI was 27.16 kg/m2 on average. The results of the current investigation were comparable to the study done by Saha BK et al.[16] Patients who had hyponatremia at the time of admission in their study tended to be older than those who had sodium levels that were normal. Males accounted for 81% of patients admitted with hyponatremia.

In the study by Khan AW et al.[13],hypertension was found to be the most prevalent co-morbidity in 74 patients (44.85%), followed by Type 2 diabetes, smoking, dyslipidemia, obesity, and a family history of cardiovascular diseases in 40 patients (24.24%), 36 patients (21.82%), 20 patients (12.12%), 18 patients (10.91%), and 15 patients (9.09%), respectively. This was comparable to the current study, in which patients with STEMI most frequently had hypertension and diabetes as co-morbidities. According to a study by Jamil et al.[15], 47.2% of STEMI patients had hypertension as a co-morbid condition, followed by diabetes mellitus, dyslipidemia, and obesity.

Hyponatremia was associated with a smoking history, inferior wall MI, a lower ejection percentage, and a higher Killip class. Additionally, patients with hyponatremia had greater ST elevation magnitude. Saha BK et al.[16] observed that patients with hyponatremia were more likely to be smokers (81%), diabetic (44%), had anterior wall infarction (72%), and had a higher killip class and a lower ejection fraction (40.36±6.14) than individuals with normal sodium levels. Similar findings were made by Pasha G et al.[17] in their study, which demonstrated significant outcomes for the hyponatremia group with Killip class, ejection fraction, diabetes, and smoking.

The mortality was found among 5(13.51%) and frequency of acute heart failure was found in 17 (45.95%) patients with hyponatremia. In the study conducted by Shahid MA et al.[12] with 52 hyponatremic patients, 27 patients (53.8%) died and 19 (36.5%) experienced acute cardiac failure often. With a p-value of less than 0.05, hyponatremia was found to be linked to a higher risk of hospital death and acute HF.

In addition, Devi KB et al.[14] observed that hyponatremia was linked to Killip III and IV, higher CK-MB levels, and a greater degree of ST-elevation (P = 0.002, 0.010, and 0.002, respectively). Pasha G et al.[17] reported that patients who were diagnosed with hyponatremia on admission had a slightly higher percentage (23%) of mortality, resulting in three deaths in 13 patients, whereas those with hyponatremia within 72 hours had two deaths in 14 patients (14.28%).

## CONCLUSION:

Electrolyte imbalances significantly raised the rate of hospital

mortality and resulted in life-threatening situations. Males, elderly patients, and those with a history of smoking are more likely to have low sodium levels than are younger patients. Hyponatremia is more likely to occur in individuals with inferior wall MI, low ejection fraction, and greater ST elevation than in patients with normal salt levels. Serum sodium concentrations can be used as a basic biochemical diagnostic to identify patients who are more likely to experience unfavorable outcomes.

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**Conflicts Of Interest:**
There are no conflicts of interest

**REFERENCES:**

1. Ralapanawa U, Sivakanesan R. Epidemiology and the magnitude of coronary artery disease and acute coronary syndrome: a narrative review. Journal of epidemiology and global health. 2021 Jun;11(2):169.
2. McGarry M, Shenvi CL. Identification of acute coronary syndrome in the elderly. Emergency Medicine Clinics. 2021 May 1;39(2):339-46.
3. Del Buono MG, Garmendia CM, Seropian IM, Gonzalez G, Berrocal DH, Biondi-Zoccai G et al. Heart failure after ST-elevation myocardial infarction: beyond left ventricular adverse remodeling. Current Problems in Cardiology. 2022 Apr 20:101215.
4. Suwanto D, Dewi IP, Fagi RA. Hyponatremia in heart failure: Not just 135 to 145. Journal of Basic and Clinical Physiology and Pharmacology. 2021 Jun 17;33(4):381-8.
5. Vogel B, Claessen BE, Arnold SV, Chan D, Cohen DJ, Giannitsis E et al. ST-segment elevation myocardial infarction. Nature reviews Disease primers. 2019 Jun 6;5(1):39.
6. Groenewegen A, Rutten FH, Mosterd A, Hoes AW. Epidemiology of heart failure. European journal of heart failure. 2020 Aug;22(8):1342-56.
7. Shah V, Jahan N. Prognostic significance of hyponatremia in ST-elevation myocardial infarction/heart failure patients. Cureus. 2019 Sep 16;11(9).
8. Lilly LS, Dzau VJ, Williams GH, Rydstedt L, Hollenberg NK. Hyponatremia in congestive heart failure: implications for neurohumoral activation and responses to orthostasis. The Journal of Clinical Endocrinology & Metabolism. 1984 Nov 1;59(5):924-30.
9. Filippatos TD, Elisaf MS. Hyponatremia in patients with heart failure. World journal of cardiology. 2013 Sep 9;5(9):317.
10. van Kimmenade RR, Januzzi Jr JL. Emerging biomarkers in heart failure. Clinical chemistry. 2012 Jan 1;58(1):127-38.
11. Chatterjee K. Neurohormonal activation in congestive heart failure and the role of vasopressin. The American journal of cardiology. 2005 May 2;95(9):8-13.
12. Shahid MA, Bhatti SM, Mahmud M, Pervaiz M. Hyponatremia in Patients with Acute ST Elevation Myocardial Infarction: Evaluate the Short Term Outcomes. Pakistan Journal of Medical & Health Sciences. 2022 Jun 25;16(04):1146-.
13. Khan AW, Hussain A, Hussain SL, Khan TA, Zadran N. Examine the Frequency and Short Term Outcomes of Hyponatremia in Patients with Acute ST Elevation Myocardial Infarction. Age (yrs).;56:10-46.
14. Devi KB, Chanu KJ, Ram R, Narayanaswamy G, Singh KB, Chongtham DS. Profile of acute ST-elevation myocardial infarction patients with hyponatremia. Journal of Medical Society. 2017 May 1;31(2):119-22.
15. Jamil M, Ali U, Siraj J, Din IU, Ahmad T, Abbas M, et al. Frequency of hyponatremia and its short term clinical outcomes after acute ST elevation myocardial infarction. Pak Heart J 2019; 52 (04):307-12.
16. Saha BK, Uddin K, Khan MA, Azad MA, Barai LC. Study of hyponatremia as prognostic factor in acute ST elevation myocardial infarction (STEMI): A study in national institute of cardiovascular diseases and hospital, Dhaka, Bangladesh. 2019 may; 01(01): 8 -11.
17. Pasha G, Marulashresta GD Kumar SR V. A study on prognostic significance of hyponatremia in acute: St-elevation myocardial infarction. International Journal of Advanced Research in Medicine 2021; 3(2): 440-44.