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ORIGINAL ARTICLE

Hyponatremia in Patients with Acute ST Elevation Myocardial Infarction: Evaluate the Short Term Outcomes

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ABSTRACT

Aim: Hyponatremia and its related short-term consequences such as death during hospitalization and heart failure in patients with acute myocardial infarction need to be studied.

Study Design: Cross-sectional/observational study

Place and Duration: Deptt of Cardiology, Fatima Jinnah medical university / Sir Ganga Ram Hospital Lahore. Dec 2020-Nov2021

Materials and Methods: A total of 125 patients, equally split across sexes, ranging in age from 18 to 80, were included in this research. After obtaining written agreement from patients, demographic data was collected. The sodium concentration in the blood was measured using blood samples taken from the participants. Sodium levels of less than 135 millimol/L (mmol/L) were characterized as hyponatremia. Death and heart failure were considered as outcomes. SPSS 22.0 was used to analyze the data.

Results: Among 125 patients, there were 75 (60%) were male and 50 (40%) were females and had mean age 53.8±11.61 years. Frequency of hyponatremia was found among 52 (40%) patients and sodium level >135mmol/L was found among 73 (60%) patients.Among 52 hyponatremic patients, mortality was found among 27 (53.8%) and frequency of acute heart failure was found in 19 (36.5%) . Hyponatremia was shown to be associated with an increased risk of death in the hospital and acute heart failure, with a p-value of less than 0.05.

Conclusion: According to the findings, hyponatremia is common in patients with acute mycocardial infarction and is related with a higher risk of death during hospitalization and an increased risk of acute heart failure.

Keywords: Hyponatremia, Heart Failure, ST segment Myocardial Infarction, Mortality,

INTRODUCTION

Acute coronary syndromes (ACS) include ST-segment elevation infarction (STEMI).[1] In affluent nations, STEMI remains a serious health issue. In developing countries, STEMI is becoming an even more significant issue. [2] The most common electrolyte anomaly in hospitalised patients is hyponatremia, which is defined as sodium levels in the blood below 135 mEq/L. It has been used as a predictor of the severity and prognosis of several diseases. [3,4] Among those who have had an acute myocardial infarction, hyponatremia is a significant risk factor for death (AMI). [5,6] Angiotensin-converting enzyme (ACE) and sympathetic nervous system (SNS) activation are also related with hyponatremia in patients with acute myocardial infarction (AMI). In some individuals, these processes may have a detrimental effect on their long-term survival. Neurohormonal activation of the renin-angiotensin-aldosterone system, as well as sympathetic overstimulation owing to lower stroke volume and underfilling of arteries, might explain the incidence of hyponatremia in these individuals [8]. There have been a number of clinical trials and observational studies to evaluate the effect of serum sodium levels on the prognosis of STEMI and HF patients. As a result, the mortality of STEMI, HF patients is strongly linked to their low sNa status on admission. For now, hyponatremia is still a mystery among patients with STEMI and heart failure, but one thing is clear: early detection might lead to earlier treatment of people at risk for developing hyponatremia, which could improve their prognosis.

Heart failure is usually accompanied with hyponatremia in the early stages of ST-elevation myocardial Infarction (STEMI) (HF). A poor outcome is related with hyponatremia in acute [11] STEMI, which occurs in 11% of cases. Patients with hyponatremia during the acute STEMI were more likely to develop acute cardiac failure (11.7 percent) [12]. Consequently, it has been shown to be a predictor of short- and long-term mortality, as well as acute and chronic heart failure and re-hospitalization, in the acute phase of STEMI. [13] Heart failure and in-hospital mortality were both independently linked with hyponatremia in individuals with STEMI. This study found that hyponatremia during the acute phase increased the probability of worse in-hospital outcomes in patients [14] with STEMI (of whom PCI was done in 88.5 percent). As a result, hyponatremia at the time of admission or early development was a reliable indicator of short-term mortality in patients with acute STEMI. [15] Electrolyte imbalances, particularly hyponatremia, are often missed in individuals with a STEMI. There is no current information on the frequency of hyponatremia in STEMI patients who have had local treatment. This research will help us understand the scope of the issue in the local community, as well as its clinical consequences in terms of mortality and acute heart failure among hyponatremia patients.

The study's goal was to find out how common hyponatremia is following an acute ST-elevation myocardial infarction and what effect it has on patients' short-term health.

MATERIALS AND METHODS

This cross-sectional/observational study was conducted at Department of Cardiology Hospital Fatima Jinnah medical university / Sir Ganga Ram Hospital Lahore during from the period 2020 to 2021. For this research, 125 people with an acute ST segment myocardial infarction of both genders participated. Patients ranged in age from eighteen to eighty-eighty. Data on patients' demographics and co-morbidities such hypertension and diabetes mellitus were collected after the patient signed a written permission form. Patients with acute renal failure, chronic liver disease, congestive heart failure, and those who had not given their permission were eliminated.

The blood sodium level was measured in all of the patients at the time of admission as well as 48 hours after the hospitalisation. Hyponatremia was defined as a serum sodium concentration of less than 135 mmol/L. The researchers looked at outcomes such as death during the hospitalisation and acute heart failure. SPSS 22.0 was used to analyse all of the data. The mean and standard deviation were calculated. The frequencies and percentages were recorded in a tabulation format for further reference. The chi-square test was used to compare the outcomes between hyponatremic and non-hyponatremic patients in order to

assess the relationship between the two. A p-value of less than 0.05 was considered statistically significant for the association.

RESULTS

Among 125 patients, there were 75 (60%) were male and 50 (40%) were females and had mean age 53.8±11.61 years. The mean BMI was 28.8±5.42 kg/m^2. (Table 1)

Table-1: A complete details of each patient's medical history

Variables	Frequency	Percentage
Mean age (years)	53.8±11.61	
Mean BMI (kg/m^2)	28.8±5.42	
Gender		
Male	75	60%
Female	50	40%

Hypertension and diabetes mellitus were the most common comorbidity found among all cases followed by smoking, dyslipidemia, obesity and family history of cardiovascular disease.(fig 1)

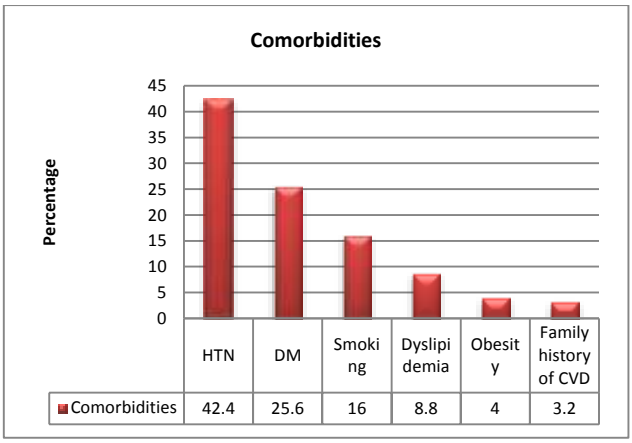

Figure-1: Association of comorbidities among all cases

The mean serum sodium level was 135.11±9.71 mmol/L at admission and at 48 hours mean sodium level was 135.17±10.73 mmol/L. Frequency of hyponatremia was found among 52 (40%) patients and sodium level >135mmol/L was found among 73 (60%) patients. (fig 2)

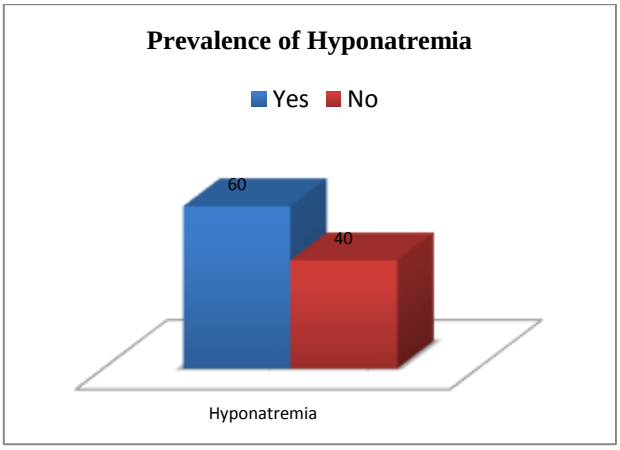

Figure-1: Hyponatremia is a common complication in people with AMI

Among 52 hyponatremic patients, mortality was found among 27 (53.8%) and frequency of acute heart failure was found in 19 (36.5%). Hyponatremia was shown to be associated with an increased risk of death in the hospital and acute heart failure, with a p-value of less than 0.05.(table 2)

Table-2: Hyponatremia-related outcomes

Hyponatremic	Frequency (n=52)	Percentage
Mortality		
Yes	27	53.8%
No	25	46.2%
Heart Failure		
Yes	19	36.5%
No	31	63.5%

DISCUSSION

Infarction is the largest cause of mortality in the world, and it is a frequent medical emergency. An electrolyte disorder known as hyponatremia has been linked to poor outcomes in individuals suffering from acute and chronic cardiac illnesses, such as left ventricular heart failure and acute myocardial infarction. Hyponatremia has a substantial effect on the prognosis of heart failure patients. Data on its importance in patients with myocardial infarction are few at the moment nevertheless.

In present study there were 125 patients of both genders were presented. Among 125 patients, there were 75 (60%) were male and 50 (40%) were females and had mean age 53.8±11.61 years. The mean BMI was 28.8±5.42 kg/m^2. Hypertension and diabetes mellitus were the most common comorbidity found among all cases followed by smoking, dyslipidemia, obesity and family history of cardiovascular disease. These results were comparable to the previous some studies.[16,17] Hyponatremia in individuals with acute myocardial infarction (AMI) is a complicated problem. It is possible that vasopressin may be released in reaction to pain, nausea, and stress, which may lead to hyponatremia in patients with heart failure in the early stages of their illness. [18] Aquaporin-2 channels are inserted into the collecting duct cell membrane when vasopressin levels are elevated, increasing water permeability in the renal collecting duct. Hyponatremia is also caused by neurohormonal activation in AMI. Vasoconstriction occurs in individuals with AMI due to increased activation of the sympathetic nervous system and the renin–angiotensin–aldosterone system. [19]

The mean serum sodium level was 135.11±9.71 mmol/L at admission and at 48 hours mean sodium level was 135.17±10.73 mmol/L. Frequency of hyponatremia was found among 52 (40%) patients and sodium level >135mmol/L was found among 73 (60%) patients. Among 52 hyponatremic patients, mortality was found among 27 (53.8%) and frequency of acute heart failure was found in 19 (36.5%). Hyponatremia was shown to be associated with an increased risk of death in the hospital and acute heart failure, with a p-value of less than 0.05. According to a study by Singla et al, a sodium concentration below 135 mmol/L was linked to an elevated risk of 30-day death or recurrence in nonSTEMI patients. [20] According to Klopotowski et al, hyponatremia at 19 admission doubled the likelihood of cardiac failure or mortality in STEMI patients. [21] Long-term mortality and re-admission for heart failure were shown to be higher in hyponatremic patients, according to Goldberg et al. Patients with hyponatremia were found in 12 percent of the study's participants, and 24 percent of those patients died within three months. [22]

Compared to prior research, the current investigation found that early hyponatremia was not only common, but it also had a similar predictive value for heart failure, independent of the therapy. [23] A higher incidence was seen in patients above the age of 70, however the difference was not statistically significant. Because of the research's tiny sample size, this finding may be considered inconsequential, although Hasoor et al., who conducted a similar study, found a similar sample size. [24] Cardiovascular events such cardiac arrest, congestive heart failure (CHF), arrhythmias, AV block and mortality have been linked to patients with higher Killip class, raised CK-MB level and higher ST-segment elevation levels, according to a number of studies. This

study demonstrated that hyponatremia was linked to poor outcomes in STEMI patients, hence it can be stated that it is a risk factor for bad outcomes. Patients who have a high level of serum sodium may be identified as having a greater risk of acquiring negative effects.[25]

CONCLUSION

Patients who had electrolyte imbalances had a higher death rate and more life-threatening outcomes in the hospital. We came to the conclusion that hyponatremia was common in individuals with acute mycocardial infarction and was closely linked to death and acute heart failure while in the hospital.

REFERENCES

1 Cannon CP, Braunwald E. Non-ST-segment elevation acute coronary syndrome (non-ST-segment elevation myocardial infarction and unstable angina). In: Kasper DL, Fauci AS, Hauser SL, Longo DL, Jameson JL, Loscalzo J, editors. Harrison's Principle of Internal Medicine. 19th ed. New York: McGraw Hill; 2015. p. 1593-8.

2 Scirica BM, Morrow DA. ST-elevation myocardial infarction: Pathology, pathophysiology, and clinical features. In: Mann DL, Zipes DP, Libby P, Bonow RO, Braunwald E, editors. Braunwald's Heart Disease: A Textbook of Cardiovascular Disease. 10th ed. Philadelphia: Elsevier Saunders; 2014. p. 1068-94

3 Waikar SS, Mount DB, Curhan GC. Mortality after hospitalization with mild, moderate, and severe hyponatremia. Am J Med 2009;122:857–65

4 Klopotowski M, Kruk M, Przyluski J, et al. Sodium level on admission and in-hospital outcomes of STEMI patients treated with primary angioplasty: the ANIN Myocardial Infarction Registry. Med Sci Monit 2009;15:CR477–83

5 Tang Q, Hua Q. Relationship between hyponatremia and in-hospital outcomes in Chinese patients with ST-elevation myocardial infarction. Intern Med 2011;50:969–74

6 De Smet HR, Menadue MF, Oliver JR, et al. Increased thirst and vasopressin secretion after myocardial infarction in rats. Am J Physiol Regul Integr Comp Physiol 2003;285:R1203–11

7 Fraccarollo D, Galuppo P, Hildemann S, et al. Additive improvement of left ventricular remodeling and neurohormonal activation by aldosterone receptor blockade with eplerenone and ACE inhibition in rats with myocardial infarction. J Am Coll Cardiol 2003;42:1666–73

8 Goldberg A, Hammerman H, Petcherski S, et al. Hyponatremia and long-term mortality in survivors of acute ST-elevation myocardial infarction. Arch Intern Med 2006;166:781–6

9 Sigurdsson A, Swedberg K: Left ventricular remodeling, neurohormonal activation and early treatment with enalapril (CONSENSUS II) following myocardial infarction. Eur Heart J. 1994, 15:14-9.

10 Fraccarollo D, Galuppo P, Hildemann S, Christ M, Ertl G, Bauersachs J: Additive improvement of left ventricular remodeling and neurohormonal activation by aldosterone receptor blockade with eplerenone and ACE inhibition in rats with myocardial infarction. J Am Coll Cardiol. 2003, 42:1666-73.

11 Tada Y, Nakamura T, Funayama H, Sugawara Y, Ako J, Ishikawa S, et al. Early development of hyponatremia implicates short- and long-term outcomes in ST elevation acute myocardial infarction. Circ J 2011;75:1927-33

12 Klopotowski M, Kruk M, Przyluski J, Kalinczuk L, Pregowski J, Bekta P, et al. Sodium level on admission and in-hospital outcomes of STEMI patients treated with primary angioplasty: the ANIN Myocardial Infarction Registry. MedSci Monit 2009;15(9):477-83

13 Chung HM, Kluge R, Schrier RW, Anderson RJ. Postoperative hyponatremia: a prospective study. Arch Intern Med 1986;146:333-6.

14 Havranek S, Belohlavek J, Skulec R, Kovarnik T, Dytrych V, Linhart A. Long-term prognostic impact of hyponatremia in the ST-elevation myocardial infarction. Scand J Clin Lab Invest 2011;71:38-44.

15 Klein LO, Connor CM, Leimberger JD. Lower serum sodium is associated with increased short-term mortality in hospitalized patients with worsening heart failure: results from the Outcomes of a Prospective Trial of Intravenous Milrinone for Exacerbations of Chronic Heart Failure (OPTIME-CHF)Study. Circ J 2005;111:2454-60.

16 Ma QQ, Fan XD, Li T, Hao YY, Ma F. Short- and long-term prognostic value of hyponatremia in patients with acute coronary syndrome: A systematic review and meta-analysis. PLoS One. 2018;13(3):e0193857. Published 2018 Mar 2.

17 Choi JS, Kim CS, Bae EH, et al. Prognostic impact of hyponatremia occurring at various time points during hospitalization on mortality in patients with acute myocardial infarction. Medicine (Baltimore). 2017;96(23):e7023.

18 Adrogue HJ, Madias NE. Hyponatremia. N Engl J Med 2000;342:1581–9.

19 Anzai A, Anzai T, Naito K, et al. Prognostic significance of acute kidney injury after reperfused ST-elevation myocardial infarction: synergistic acceleration of renal dysfunction and left ventricular remodeling. J Card Fail 2010;16:381–9

20 Klopotowski M, Kruk M, Przyluski J, Kalinczuk L, Pregowski J,Bekta P, et al. Sodium level on admission and in-hospital outcomesof STEMI patients treated with primary angioplasty: The ANINMyocardial Infarction Registry.Med SciMonit2009;15:CR477-83

21 Tareen N, Martins D, Nagami G, Levine B, Norris KC. Sodiumdisorders in the elderly. J Natl Med Assoc2005;97:217-24

22 Klopotowski M, Kruk M, Przyluski J, Kalinczuk L, Pregowski J, Bekta P, et al. Sodium level on admission and in-hospital outcomes of STEMI patients treated with primary angioplasty: the ANIN Myocardial Infarction Registry. MedSci Monit 2009;15(9):477-83.

23 Jamil M, Ali U, Siraj J, Din IU, Ahmad T, Abbas M, Jan HU. Frequency of hyponatremia and its short term clinical outcomes after acute ST elevation myocardial infarction. Pak Heart J 2019; 52 (04):307-12

24 Hasoor S, Kinagi A, Afiya S. A prospective study of in hospital outcome of acute phase of STEMI with hyponatremia. J Evol Med Dent Sci 2014;3:14483-92

25 Devi KB, Chanu KJ, Ram R, Narayanaswamy G, Singh KB, Chongtham DS. Profile of acute ST-elevation myocardial infarction patients with hyponatremia. J Med Soc 2017;31:119-22