DOI: https://doi.org/10.53350/pjmhs211571825

ORIGINAL ARTICLE

To Determine the Frequency of Hyponatremia and its Association with the Risk Factors and its Impact on In-hospital Outcome in Patients with Acute ST Elevation Myocardial Infarction

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ABSTRACT

Objective: To determine the frequency of hyponatremia and itsassociation of with associated factors and its impact on in-hospital outcome in patients with acute ST elevated myocardial infarction.

Study Design: AnalyticalStudy.

Study Setting: Study was conducted at Aga Khan University Hospital, Karachi (AKUH).

Subjects and Methods: This is an analytical study conducted at Aga Khan University Hospital, Karachi (AKUH) between the period of 2016 to 2017.Informed consent to enroll and use data of patients was obtained from all the 225 patients before commencing the study. All patients of age between 20 to 75 years of either gender diagnosed with ST elevation acute myocardial infarction in emergency or outpatient department were enrolled in the study.Hyponatremia was labelled as serum sodium level less than 135mEq/L (Normal is 135-145mEq/L).A detailed history was taken followed by complete examination at admission.In hospital outcomes were measured within 72 hours of admission. Report was collected and findings were noted in the Performa.Data was analyzed on SPSS Version 16.

Results:A total of 225 patients admitted in Department of Cardiology, Aga Khan University Hospital, Karachi were included in this study. Mean age in our study was 56.80±7.56 years.135 (60%) were male and 90 (40%) were female. Out of 225 patients, 43 (19.1%) had hyponatremia and 182 (80.9%) did not have hyponatremia. In-hospital mortality was 22 (100%) who had hyponatremia.

Conclusion: The results showed that hyponatremia has very strongly association with in-hospital mortality. Cardiovascular mortality among patients with acute STElevationmyocardial infarction. Plasma sodium levels may serve as a simple marker to identify patients at risk.

Key Words: Acute ST elevated myocardial infarction,Hyponatremia, in-hospital mortality, associated factors.

INTRODUCTION

Acute myocardial infarction (AMI) is one of the leading causes of death. It is also defined as most common in-hospital diagnosis globally(1). Between the years 1990 to 2010, ischemic heart diseases had been found to diminish life years by seventy three percent in South Asian and thirty percent worldwide. In countries such as Pakistan, India, Nepal, Bangladesh, and Sri Lanka, myocardial infarction has been diagnosed ten years earlier as compared to other countries(2, 3). The incidence of sudden death due cardiac failure has been reported as around three million per year(4). Electrolytes imbalance is most common sequel post myocardial infarction. The prognosis of myocardial infarction is significantly affected by electrolyte imbalance. Moreover, imbalance in levels of electrolytes are associated with acute myocardial infarction(5, 6). Sodium is one of the electrolytes that is commonly affected during the ongoing episode of acute myocardial infarction. Low levels of sodium merely less than 135mmol/l is considered as hyponatremia(7).

Multiple researchers have reported prevalence of myocardial infarction induced hyponatremia ranging between twelve to thirty seven percent. In addition, positive correlation has been found between prognosis of myocardial infarction and hyponatremia (8-12). In a clinical setting, hyponatremia indicates severity and prognosis of the myocardial infarction. Complex mechanisms are involved in causing lower sodium levels in myocardial infarction patients. It has been suggested that release of vasopressin during cardiac failure might be responsible for causing hyponatremia. The survival rates are highly affected by these mechanisms (11, 13, 14).

Studies have also shown significant association between severe hyponatremia and mortality rates. In patients having ST elevation myocardial infarction and non-ST elevation acute coronary syndrome, hyponatremia causes poor prognosis (8, 9, 15). It has been reported that the odds of having mortality is sixty times higher in hyponatremic patients as compared to the patients having normal sodium concentration. Cardiac failure is most common outcome associated with hyponatremic patients (7, 8). Tang Qet al. reported 13% prevalence of hyponatremia with 14% inhospital mortality. Furthermore, in-hospital adverse outcomes were significantly associated with hyponatremia as compared to normal sodium levels (16).

Low sodium levels activate baroreceptor mediated hormones such as activation of renin-angiotensin mechanism and release of vasopressin and catecholamine (17). The activation of baroreceptor mechanism has deleterious effects on heart causing heart failure. The prevalence of cardiovascular diseases particularlyacute ST

elevation myocardial infarction is very high in Pakistan and the incidence is also rising gradually leading to morbidity and mortality(18).The impact of hyponatremia inacute ST elevation myocardial infarction is yet to be investigated. Thus, it is essential to explore the association of hyponatremia and in-hospital outcomes.Preliminary research proposes a probablelink between sodium concentration and worst cardiac outcomes among in-hospital patients. The similar research is yet to be conducted in local setting to elucidate the impact of clinical finding upon patients' outcomes.Hyponatremia is a curable condition which could aid in reducing mortality. Owing to its clinical application, serum sodium levels serve as prognostic marker in acute myocardial infarction particularly in hospitalized patients. Thus, it is crucial to ascertain the association of hyponatremia with associated factors and its impact on in-hospital outcome in patients with acute ST elevated myocardial infarction

MATERIAL AND METHODS

This is an analytical study conducted at Aga Khan University Hospital, Karachi (AKUH) betweenperiod of 2016 to 2017. The study was initiated after approval with institutional ethical review committee. The sample size was calculated using OpenEpi an online sample size calculator by using statistics from previous literature for frequency of hyponatremia in ST Elevation myocardial infarctionpatients as 13% (16).To estimate the proportion of hyponatremia between 10% to 15%, using 95% confidence level and taking margin of error as 5%, the minimum sample size was of 225 patientafter inflating by 15% to account for non-response. The sample size is also sufficient to test for a 15% higher mortality among hyponatremia STEMI patients above the 7% mortality reported in patients with normal sodium levels, with a confidence 95%.

Informed consent to enroll and use data of patients was obtained from all the patients before commencing the study. All patients of age between 20 to 75 years of either gender diagnosed with ST elevation acute myocardial infarction in emergency or outpatient department were enrolled in the study.The patients were then admitted in the Cardiology Unit of the hospital for further evaluation.

Myocardial infarction was labelled as continuous sharp chest pain for more than 30 minutes radiating towards shoulder and jaw which is not relieving by sublingual nitrates and ECG showing ST elevation >2mm in two or more contiguous chest leads, or more than 1mm in two or more contiguous limb leads and presence of any one of the following.

Patients already diagnosed as congestive heart failure, chronic liver disease, chronic kidney disease, Sepsis, Metastatic cancer, Syndrome of inappropriate diuretic hormone, hypothyroidism were excluded from the study.

Hyponatremia was labelled as serum sodium level less than 135mEq/L (Normal is 135-145mEq/L).A detailed history was taken followed by complete examination at admission. A 5cc disposable syringe was used to draw 5 ml of blood from peripheral vein and this sample was collected in the specific tube for the measurement of serum sodium level at the time of admission and sample was transported to AKUH standardized laboratory by proper labeling as well as the investigation requested. Reporting was done by a qualified Biochemist. In hospital outcomes were measured within 72 hours of admission that is within 3 days. Report was collected and findings were noted in the Performa approved by researcher.

Data was analyzed on SPSS Version 16. Demographic data was presented as simple descriptive statistics as mean + SD for continuous variables like age. Frequencies and percentages were calculated for categorical variables like gender, hypertension, diabetes, smoking, family history positive for coronary artery disease and hyponatremia. Possible associated factors like age, gender, smoking, diabetes, hypertension, and family history for coronary artery disease was compared with hyponatremia. To test for the relationship between hyponatremia and In-hospital outcome interms of survival within 72 hours, the chi-square was applied, with a level of significance set at ≤0.05.

RESULT

A total of 225 patients admitted in Department of Cardiology, Aga Khan University Hospital, Karachi were included in this study. The minimum age of the patient was 29 while maximum age of the patients was 71 years. Mean age in our study was 56.80 years with the standard deviation of ±7.56.Out of 225 patients, 135 (60%) were male and 90 (40%) were female. Most of the patients were male.Age wise distribution showed that, 7 (3.1%), 37 (16.4%), 69 (30.7%), 64 (28.4%) and 48 (21.3%) patients were in age group 20-30 years, 31-40 years, 41-50 years, 51-60 years and 61-75 years respectively. Approximately 20% of the patients were younger. The findings shown 101 (44.9%) patients have diabetes mellitus, 119 (52.9%) have hypertension, 68 (30.2%) patients were smoker in our study whileFamily history of coronary artery disease found in 41 (18.2%) patients. It was observed that in these patients co-morbidities are very common.Out of 225 patients, 43 (19.1%) had hyponatremia and overall in-hospital mortality showed in 203 (90.2%) patients and 22 (9.8%) survived and expired respectively.

Association between factors like age, gender, co-morbidities, family history of heart disease and smoking status with hyponatremia have observed in table 2.Further, hyponatremia and in-hospital mortality showed that 22 (100%) and 21 (10.3%) had and did not have In-hospital mortality in patients who had hyponatremia respectively. Whereas 00 (00%) and 182 (89.7%) had and did not have In-hospital mortality in patients who did not have hyponatremia respectively. Findings showed significant association between hyponatremia and in-hospital adverse outcomes (P-value:0.000).

Table: 1 Descriptive statistics of patient's characteristics:

Patient's Characteristics	Statistics
Age(in years)	56.8+/-7.56(29-71)
Gender	
Male	90(40%)
Female	135(60%)
Diabetes mellitus	101(44.89%)
Hypertension	119(52.89%)
Smoker	68(30.22%)
Family history of CAD	41(18.22%)

Figure: 1

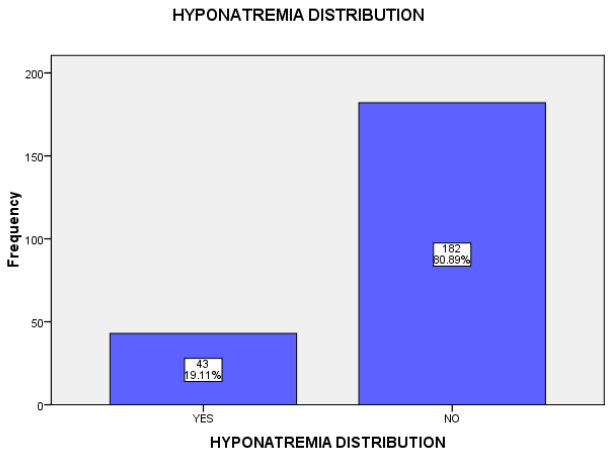

Table 2: Association of Hyponatremia with related factors

Associated factors	Hyponatremia		Total	P-value
	Yes	No		
Age groups (in years)				
<41	15(34.1%)	29(65.9%)	37(100%)	0.004*
41-50	5(7.2%)	64(92.8%)	69(100%)	
51-60	12(18.8%)	52(81.2%)	64(100%)	
>60	11(22.9%)	37(77.1%)	48(100%)	
Gender				
Male	27(20%)	108(80%)	135(100%)	0.678
Female	16(17.8%)	74(82.2%)	90(100%)	
Diabetes Mellitus				
Yes	23(22.8%)	78(77.2%)	101(100%)	0.207
No	20(16.1%)	104(83.9%)	124(100%)	
Hypertension				
Yes	27(22.7%)	92(77.3%)	119(100%)	0.131
No	16(14.8%)	92(85.2%)	106(100%)	
Smoking status				
Yes	12(17.6%)	56(82.4%)	68(100%)	0.713
No	31(19.7%)	126(80.3%)	157(100%)	
Family history of CAD				
Yes	6(14.6%)	35(85.4%)	41(100%)	0.420
No	37(20.1%)	147(147%)	184(100%)	

Table-3: Association of Hyponatremia and in-hospital mortality n=225

Hyponatremia	In-hospital mortality		Total
	Yes	No	
Yes	22 (51.2%)	21 (48.8%)	43(100%)
No	00 (00%)	182 (100%)	182(100%)
Total	22 (9.8%)	203 (90.2%)	225(100%)
P-value	0.000*		

DISCUSSION

Electrolyte disorder is most common finding among acute myocardial infarction. Among electrolyte imbalance, serum sodium levels are highly affected. Among all the subjects, 19.11% patients had hyponatremia. Researchers have claimed that hyponatremia in early stages of myocardial infarction could be an independent prognostic marker for cardiac heart failure in hospitalized patients (7). Tareen N et al. stated hyponatremia reflect poor clinical outcomes in heart patients. In comparison with non-ST elevation, it was noted that hyponatremia was significantly associated with 30 days mortality and recurrence of myocardial infarction episode (19). Goldberg et al. also stated hyponatremia played significant role in long and short term mortality in ST elevation myocardial infarction patients(8). However, Lazzeri et al. observed contradictory results. He found that low sodium levels were not associated with mortality in patients whose baselines were managed. His study also claimed that hyponatremia is not a prognostic marker but can be used to assessed the severity in acute myocardial infarction patients (20).

The inconsistent results among studies can be subjective to difference in management of these patients regarding primary intervention and medical approach. Acute myocardial infarction is a result of activation of renin angiotensin system and production of catecholamines that causes vasoconstriction leading to reduced glomerular filtration rate. Developments in therapeutic approaches arrest the heart failure and inhibits activationneuro-hormonal mechanisms that have played significant role improving survival rates.Therefore, the influence of hyponatremia on clinical outcomes should be re-explainedfor primary intervention.Multiple researchers have shown a positive association between low sodium levels and higher mortality s compare to patients having normal sodium levels (P<.001) (11, 21). In a study, it was found that the chances post discharge death was higher in patients having hyponatremia (hazard ratio: 2.0; 95%CI: 1.3-3.2; P = .002) and the risk of post discharge readmission with heart failure was also higher in hyponatremic patients (Hazards Ratio, 1.6; 95% CI, 1.1-2.6; P = .04)(8).

In another study, almost 18% patients had hyponatremia on admission. During a middle subsequent time of six years around 15% patients died. Long term mortality was associated with hyponatremia with higher risk among age and gender stratification. After further management of hemoglobin, reduced left ventricular ejection fraction(LVEF), hypertension, glomerular filtration rate, hyperlipidemia, diabetes, any recanalization treatment, hyponatremia remains an indicator for mortality (Hazards ratio 1.61; 95% CI 1.32–1.97)(13).The present study showed that majority of the patients had hypertension followed by diabetes.30% were smokers and 18% had family history of coronary artery disease. No statistical significance was found among these factors with hyponatremia. Similar results were found in previous study (22). The mean age in the present study is 56.8+/-7.56 and is significantly associated with hyponatremia. The results are in concurrence with other studies as in various studies, it has been established that age is a risk factor for hyponatremia(8, 19).In another study, impact of sodium levels were assessed on in-hospital outcomes in-hospital outcomes among patients undergone primary angioplasty while compared the outcome between normal sodium levels and low sodium levels and assessed whether sodium is responsible for heart failure or in hospital mortality. This study found that patients having low sodium levels had higher mortality rate. And hazards ratio was calculated which showed patients having low sodium levels are 3.89 times at risk of in-hospital mortality (9). In the present study, hyponatremia havehighly significant association with in-hospital mortality.

CONCLUSION

The results showed that hyponatremia has very strongly significant association with in-hospital adverse outcome(mortality). Hyponatremia is a manage condition. However, late diagnosis of hyponatremia leads to increase in poor prognosis of the patients. Early detection of hyponatremia could save the patient from experiencing unfavorable outcomes and increase survival rates. Comorbidities are highly prevalent in hospitalized patients which render the management very challenging. Clinicians are also restricted to initiate specific treatment plan as comorbidities could make adverse outcomes. Hence, hyponatremia in acute myocardial patients should be managed as early as possible.During management of these patients, the chaos of multiple chronic conditions is often neglected, and patient's health deteriorates rapidly. Therefore, there should be combination to treat multiple conditions.

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