

Prognostic Importance of Hyponatremia in Acute STEMI

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Abstract

Background: Hyponatremia develops in early phases of acute myocardial infarction, recently, several studies showing its importance as important early prognostic tool. Many studies shown that significant increase in plasma AVP level was in patients who had associated with complication as heart failure and fatal outcome after acute MI, and clinical improvement was noted following the rise in serum plasma level of sodium. hence Early developed hyponatremia is a unique indicator of neuro hormonal activity in the early phases of recent MI, so it can help predict the complication as long-term development of HF and death. **OBJECTIVE:** To observe the prognostic importance of hyponatremia in settings of acute STEMI event and helpfulness in prediction of short term and long term survival. **Subjects and Methods:** Randomized double blinded study, in 100 of patients with acute S TEMI presented to outpatient department and indoor emergency patients. **Results:** Patients who developed hyponatremia at admission had higher mortality rate than the patients who developed hyponatremia at 72 hrs and normonatremic patients. Mortality in patients correlates with the severity of hyponatremia 5(100%) patient died with sodium levels <130mmol/l whereas 5(16%) death occurred in the patient having sodium level between 131-134. (Odds ratio 6.0, p value 0.02). **Conclusion:** We concluded that hyponatremia developed in early as well as late phases of acute STEMI serve as is an independent determinant of both short term (in hospital mortality, development of arrhythmias and heart failure) as well as long term survival (cardiac death, post discharge heart failure). Plasma sodium levels may help identify patient at risk.

Keywords: Hyponatremia, STEMI, Prognosis, Heart Failure.

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Introduction

Cardiovascular disease accounts for approx. 14 million deaths annually and to the common cause of death globally. Since past 3 decades there is considerable decline in incidence and prevalence of coronary artery disease in the industrialized western world, whereas increasing in the developing world. Coronary artery disease; deaths rates currently are 3 times more than the stroke rate.

In Community studies, it has been shown consistently that patients with suspected acute cardiac event like myocardial infarction or acute coronary syndrome, total case fatality ratio in the first month is more than 60%, and half of that occur within early hours in less than 2hrs.^[1]

Hyponatremia, a commonly occurring electrolyte deficiency found in inpatient department,^[2] more especially in cardiac care units, in surgical postoperative wards and in patients with cardiac failure.^[3-5] It has been shown as important prognostic indicator of cardiovascular mortality in patients of cardiac failure.^[6,7] In congestive cardiac failure (CCF), decreased sodium levels are linked with over activity of renin-angiotensin-aldosterone system. Catecholamine's arginine vasopressin (AVP) and baroreceptor-mediated hormones,

Hyponatremia develops in early phases of acute myocardial

infarction, recently, several studies shows the importance of hyponatremia as important early prognostic tool. Many studies shown that significant increase in plasma AVP level was in patients who had associated with complication as heart failure and fatal outcome after acute MI, and clinical improvement was noted following the rise in serum plasma level of sodium. Plasma.^[8,9] So we therefore hypothesized, presence of hyponatremia in the initial settings of acute MI suggest, at least in parts, cause increased neuro hormonal activity and affects left ventricular remodeling in acute phase of STEMI. Thus Patients presents with decreased plasma sodium levels may be attributable at much long term risk in development cardiac failure arrhythmias and mortality.

Therefore, the purpose of the this study was to test the hypothesis that hyponatremia developed early, an easy marker of neuro hormonal activation during the acute cardiac event, may predict the short term and long term complication like heart failure and death. To this end, we studied the importance of hyponatremia as prognostic marker along with impact on left ventricular ejection fraction (LVEF) in a cohort of patients who survived their index MI.

Subjects and Methods

In this proposed randomized double blinded study, 100

patients with STEMI presented outdoor and indoor emergency unit in Teerthanker Mahaveer Hospital, Moradabad. Study was explained in details to every individual and assurance of confidently was done with written consent. 3 months follow up was done.

Inclusion Criteria:

All patients of chest pain diagnosed as STEMI presented to Teerthanker Mahaveer Hospital, Moradabad with:

- Individuals with Age > 16 years
- Chest discomfort or pain occurring for more than 20 minutes
- Definitive ECG change consisting of
 - i) ST elevation >1 mm in more than two contiguous limb leads.
 - ii) ST elevation > 2mm in more than two contiguous precordial leads.

Exclusion Criteria:

- Individuals of age < 16 years
- All patients diagnosed as acute cardiac event other than STEMI

Protocol:

- 1) Thorough detailed present History with details of family, personal and past history of diabetes and proper cardiac as well as physical examination will be done.
- 2) Physical examination emphasis on body mass index that includes height and weight in kg and meter respectively
- 3) Blood pressure to be measured after proper rest of 10 minutes in right hand supine position An Electro cardiogram to be obtained at presentation and serial hourly recording to be done
- 4) After an overnight fasting, blood was taken through indwelling cannula placed in antecubital vein for general routine investigation and serum sodium levels were obtained at presentation at 0 hrs then, 24 hr ,2nd day(48 hrs) and 3rd day (72 hours), I, II and III month. All blood samples were tested in lab of Biochemistry.
- 5) Regular follow up was done till 3 months for observing the prognostic importance of hyponatremia in the setup of STEMI and looking for development of cardiac failure with symptoms of newer onset dyspnea or pulmonary edema along with definite sign, gallop rhythm, bilateral post tussiv rales in at least 1/3 of lower lung fields , jugular venous pressure elevation, or congestion of pulmonary vasculature on chest x-ray with alveolar and interstitial edema) and mortality during stay in hospital (short term) and after 3 months of discharge duration long term

Results

Table 1: Showing Hyponatremia on Admission, 72 Hrs, and 2 Months and Outcome

	Normal sodium levels (n = 65)	Hyponatremia		
		At the time of admission (n = 11)	At 72 hrs (n = 15)	At 2 months (n = 9)
CHF	8 (12.30%)	5 (45.00%)	6 (40.00%)	4 (44.5%)
Outcome (Deaths)	3 (4.60%)	4 (36.36%)	3 (20.00%)	3 (33.00%)
Arrhythmia	11 (16.00%)	5 (45.27%)	6 (40.00%)	5 (44.00%)

Patients with hyponatremia developed poorer outcome in both short and long term, A total 23(23%) patients developed heart failure and 13 (13%) patients died.

Congestive heart failure and the hospital death occurred in 5(45%) and 4(36%) of the patient respectively who presented with hyponatremia at admission and 72 hrs. (40%, 20%), the incidence of CHF and death was quite less in patient with normal sodium level.

4(44%) of hyponatremias had complaints of worsening CHF at 2nd month during follow up and 3 patients (33%) who were hyponatremia at 2nd month had suffered cardiac death. Arrhythmias developed in 27 (27%) of patients, 11(16%) of normal patients while 42 % of hyponatremia patients developed arrhythmias within 72 hrs. and 5(44%) patients presented with arrhythmia after discharge during follow up at 2nd month.

Table 2: Showing Hyponatremia on Admission, At 72 Hours and At 2 Months and Outcome In Terms Of Mortality

	Normal sodium levels	Hyponatremia		
		At the time of admission	At 72 hrs	At 2 months
No. of patients	65	11	15	9
Mortality	3(4.61%)	4(36%)	3(20%)	3(33%)

Patients who developed hyponatremia at admission had higher mortality rate (36%) than the patients who developed hyponatremia at 72 hrs. (20%) and normonatremic patients, this difference is may be due the neuro hormonal activation in early phase of STEMI. While increase in mortality at 2nd month can be described due to presence of several complications.

Table 3: Showing Severity of Hyponatremia and Outcome In Terms Of Mortality

Range of sodium levels in hyponatremia patients	No. of patients	Mortality	Odds Ratio p value
<130	5	5 (100%)	6.0
131-134	30	5 (16.66%)	0.02

Mortality in patients correlates with the severity of hyponatremia 5(100%) patient died with sodium levels <130mmol/l whereas 5(16%) death occurred in the patient having sodium level between 131-134. (Odds ratio 6.0, value 0.02)

Multivariate analyzing logistic regression analysis was performed which showed that hyponatremia was the significant predictor of both short term (development of cardiac failure, in hospital mortality and new onset arrhythmia) and long term outcome (post discharge heart failure, cardiac death)

Discussion

This study shows that the hyponatremia is frequently present in patients in early stages of STEMI. Hyponatremia if diagnosed early could be an important independent tool in detection of deterioration of CHF in hospitalized patients to overcome short term mortality. Moreover, we also found that early detection of hyponatremia could also useful predictor of heart failure and development of arrhythmias, and in the

long term for prediction of cardiac mortality. This study inspired us for need for careful monitoring in heart failure, arrhythmias in patients, if hyponatremia discovered early

In Patients, diagnosed as acute STEMI elevation myocardial infarction who were hyponatremia during admission. In our study, Total of 35% patient have hyponatremia (serum sodium level, < 136mmol/l), 11 patients (11%) being detected as hyponatremia on admission., then 15 patients (15%) develops hyponatremia in first 72 hours of hospitalization, and fraction of patient who developed hyponatremia in the end of 2 months were 9 percent after discharge during follow ups.

Goldberg et al,^[10] conducted similar study, 32.2% cases with STEMI developed hyponatremia during admission, 13 patients (12.5%) in first 24 hrs. and 208 (19.9%) patients developed low serum sodium level in the first 72 hrs. in hospitals. Total of 978 patients with STEMI with follow up in median duration of 31 months (range, 9-61 months) after hospital stay. 108 patients (11.0%) had hyponatremia in hospital. Tang Q, et al,^[11] studied the relation of hyponatremia and hospital stay outcomes Chinese population with STEMI. Among 1,620 patients, hyponatremia were reported in total of 212 (13.1%) (Sodium <136mmol/l).

Similarly Tada Y, et al,^[12] found that 3.6% of patients develops hyponatremia on admission, 20.7% (29 patients) 9.2% (13 patients) during time of discharge.

218 patients were studied in a study by Havana S, et al,^[13] (68 females, with mean age 64±13 years) without prior history of cardiac event were admitted and 33% (72) cases reported as hyponatremia; 23.4% (51) 9.6% (21) during admission and later during discharge.

Our study shows 23% (23 cases) detected with heart failure, 41% (15) were hyponatremia and 12% normonatremic patients, during admission 45% patients (odds ratio 5.93; p=0.001%) were hyponatremia, thus in accordance to Goldberg A, et al.^[10] Low serum sodium levels during repeated admission for HF was greater in patients who were hyponatremia during the first hospital admission (47.7% vs 23.1%; p =.02). In a study done by Aziz M et al,^[14] heart failure developed in 22.5 of the patients (33% hyponatremic v/s 12% in normal).

Conclusion

- In our study many patients who suffered myocardial infarction had hyponatremia at admission some had hyponatremia later in hospital or after discharge.
- Older age, diabetes, smoking, lower left ventricular ejection fraction was significantly associated with patients who developed hyponatremia as compared to normal patients.
- Development of heart failure during, and post discharge CHF were more frequent in patients who developed hyponatremia than normal patients.

- There is significant linear relationship between severity of hyponatremia with mortality and heart failure.
- Occurrence of arrhythmias were more common in hyponatremia group than normal group.
- Multivariate analysis performed, it identified that hyponatremia at initial or later stages of hospitalization can be an important independent indicator of short term and long term outcome.

We concluded that early or late development of hyponatremia in settings of acute ST elevation myocardial infarction is an important determinant of both short term (in hospital mortality, development of cardiac arrhythmias and heart failure) as well as long term outcome (cardiac death, post discharge heart failure). Thus serum sodium levels may help as unique tool to identify patient at risk.

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