

# Impact of Hyponatremia on Survival of Acute ST-Elevation Myocardial Infarction Patients during 30 Days

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**Abstract:** ***Objective:** Hyponatremia has been shown to be a predictor of cardiovascular mortality among patients with heart failure. Hyponatremia is initial insult for neurohormonal activation and left ventricular remodeling in acute myocardial infarction, both these factors are responsible with other factors for predicting short term survival in patient of acute myocardial infarctions. Hence we aimed to investigate the impact of hyponatremia in the setting of acute ST elevation MI and to determine its usefulness in predicting short term survival. **Material and methods:** 100 consecutive patients presenting with acute ST-elevation myocardial infarction admitted to M.B.S. HOSPITAL, G.M.C. KOTA, from aug 2013 to dec 2014 were studied. Qualifying patients underwent detailed history and clinical examination. Plasma sodium concentrations were obtained on admission and at 24, 48 and 72 hours thereafter. Hyponatremia was correlated with various parameters like age, male sex, diabetes, anterior infarction, killip class, mean ejection fraction. The primary end point was all cause mortality within 30 days following myocardial infarction. **Results:** In our study, substantial proportion of patients who presented with acute ST elevation myocardial infarction were hyponatremic on admission or developed hyponatremia shortly after admission. Correlation of hyponatremia was found highly significant with male sex (p value=0.012), diabetes (p value=0.04), killip class (p value=0.02), ejection fraction (p value=0.008), but no correlation was found with age, sex, smoking. We also found a significant linear relationship between severity of hyponatremia and mortality. Multivariate analysis was performed which identified hyponatremia on admission or early development of hyponatremia as a significant independent predictor of 30 day mortality. **Conclusion:** In our study we concluded that hyponatremia on admission or early development of hyponatremia in patients with acute ST elevation myocardial infarction is an independent predictor of 30-day mortality.*

**Keywords:** Acute myocardial infarction, Hyponatremia, neurohormonal activation, left ventricular remodeling, Mean EF

## 1. Introduction

Myocardial infarction is a well known clinical entity. It is one of the most fatal diseases which is world wide in distribution, affecting all races and nationalities. Myocardial infarction occurs due to imbalance between myocardial oxygen demand and coronary artery blood flow<sup>1</sup>.

An acute myocardial infarction causes a threat to circulatory homeostasis, and the activation of various neuroendocrine systems is believed to be an attempt to readjust to both myocardial and systemic consequences of the destabilizing event. Increased sympathetic nervous tone, enhanced activity of the circulating and local renin-angiotensin systems, and disturbed endocrine or paracrine function of the endothelium may all provoke vasoconstriction in the systemic and coronary vascular beds. Activation of the rennin angiotensin system also serves to induce salt and water retention and to expand circulating blood volume<sup>2,3</sup>.

Hyponatremia is a common electrolyte disorder amongst hospitalized patients<sup>4</sup>, especially in postoperative period<sup>5</sup> and in patients with heart failure<sup>9</sup> Hyponatremia has been shown to be a predictor of cardiovascular mortality among patients with heart failure<sup>6,7</sup>. In fact, the neurohormonal activation that accompanies acute myocardial infarction is similar to that which accompanies heart failure<sup>8</sup>. In myocardial infarction hyponatremia aggravated by concomitant activation of the rennin angiotensin system and increased catecholamine production sustained neurohormonal activation after myocardial infarction mainly occurs in patients with clinical heart failure and is related to the magnitude of myocardial damage, even in patients without heart failure.<sup>8</sup>

Hyponatremia is a simple marker of neurohormonal activation during the acute phase of myocardial infarction and predicts the short-term survival.<sup>10</sup>

## 2. Materials and Methods

100 consecutive patients presenting with acute ST-elevation Myocardial infarction admitted to M.B.S. hospital, G.M.C. kota, were studied. The study was carried out on patients presenting with acute ST-elevation Myocardial infarction. Those patients who had myocardial infarction without ST elevation were excluded from study. This study was done on sample of 100 patients.

Qualifying patients i. e. patients of acute Myocardial infarction who received thrombolytic therapy were undergo detailed history and clinical examination. Plasma sodium concentration were obtained on admission and at 24, 48 and 72 hours. Plasma sodium concentration were obtained by using an ISE unit of EM-360 fully auto analyser. serum CPK MB level were be obtained. The primary end point was all cause mortality within 30 days following myocardial infarction.

Various routine investigations like lipid profile, blood sugar, s.urea, s.creatinine etc. were done.

## 3. Results

In this study 100 patients of acute ST elevation myocardial infarction who had elevated serum cpkmb were studied. Out of 100 patients 80 were male and 20 were female. We divided patients of acute ST elevation MI in three subgroups. Group A, B, C. In group A, those patients who had normal sodium level, in group B those patients who

developed hyponatremia on admission and in group C those who developed hyponatremia within 72 hrs of admission. In our study we observed 17% patients of acute ST elevation MI developed hyponatremia on admission and 23% patients of acute ST elevation MI developed hyponatremia within 72 hrs of admission. While in sex wise distribution 15 males and 2 females developed hyponatremia on admission and within 72 hrs of admission 17 males and 6 females developed hyponatremia. **(Table no.1)** In our study serum sodium level was statistically significant in determining mortality. In our study mean serum sodium level was  $136.92 \pm 1.90$  in the survivors and  $134.8 \pm 3.52$  in the non survivors.

In our study we observed that old age patients had more chances for developing of hyponatremia, In our study mean age is  $51.8 \pm 12.15$  who had normal sodium level, mean age is  $55.8 \pm 10.8$  who developed hyponatremia on admission and mean age is  $53.71 \pm 9.54$  who developed hyponatremia within 72 hrs of admission.

In our study, in patients of acute ST elevation MI serum sodium, level correlated with age, male sex, diabetes, smoking hypertension, anterior infarction, killip class, mean ejection fraction. Outcome of study was seen in the form of 30 days mortality in the patients who developed acute ST elevation myocardial infarction.

In our study patients who presented or developed hyponatremia on admission had diabetes (29%), anterior infarction (16%), higher Killip class (1.11%) and lower ejection fraction ( $41.1 \pm 10.03\%$ ). Correlation of hyponatremia was found highly significant with diabetes (p value=0.0004), anterior infarction (p value=0.003), killip class (p value=0.0008), mean ejection fraction (p value<0.001) while it was not found significant with age, smoking and hypertension. **(Table No.2)**

We observed impact of hyponatremia in patient of acute ST elevation MI as 30 days survival. For this we divided patients in to two groups survivors and non survivors and correlates various factors in survivors and nonsurvivors **(Table No3)**

In our study 10 deaths (10%) occurred within 30 days of admission, 5% (3/60) in patients without hyponatremia, 17.64% (3/17) in patients with hyponatremia on admission, 17.39% (4/23) in patients who developed hyponatremia within 72 hour of admission.

In multivariate logistic regression analysis hyponatremia remains independent predictor of mortality in patients of acute ST elevation myocardial infarction.

#### 4. Discussion

In our study we found higher mortality in hyponatremic patients as well as significant linear relationship between severity of hyponatremia and mortality. We concluded that hyponatremia is a predictor for critically ill patients in acute myocardial infarction. Goldberg A et al in their study of 978 patients have concluded that early hyponatremia is a simple marker of neurohormonal activation during the acute phase

of myocardial infarction and predicts the long-term development of heart failure and death.<sup>10</sup>

Sigurdsson A, Held P, Swedberg K in their study of 55 patients with acute myocardial infarction concluded that sustained neurohormonal activation after myocardial infarction mainly occurs in patients with clinical heart failure and is related to the magnitude of myocardial damage, even in patients without heart failure.<sup>8</sup>

Tang et al also documented in their study that hyponatremia was independently associated with in hospital death and heart failure<sup>11</sup>.

In our study we also found that hyponatremia is also associated with old age, diabetes and higher killip class.

Chiara lazzeri et al conducted a study from 2004 to 2010 on 1231 patients in their study they have shown two important results 1. hyponatremia is common finding being associated mainly with older age, diabetes and advanced killip class 2. Patients with hyponatremia had higher rates of in hospital and long term mortality.<sup>12</sup>

We also documented that hyponatremia is strongly associated with male sex (p value=0.012), diabetes (p value=0.0004), anterior infarction (p value=0.003), killip class (p value=0.0008) and low mean ejection fraction in a patient of acute ST elevation myocardial infarction. Goldberg et al In present study patients who presented or developed hyponatremia on admission had diabetes (29%), anterior infarction (16%), higher Killip class (1.11%) and lower ejection fraction ( $41.1 \pm 10.03\%$ ). This is in accordance to the study conducted by Goldberg<sup>39</sup> et al. In Goldberg et al study patients those were developed hyponatremia on admission also had diabetes (43%), anterior infarction (49%), higher killip class ( $1.6 \pm 1.0$ ), and lower EF ( $42 \pm 13\%$ ).

In our study 10 deaths (10%) occurred within 30 days of admission, 5% (3/60) in patients without hyponatremia, 17.64% (3/17) in patients with hyponatremia on admission, 17.39% (4/23) in patients who developed hyponatremia within 72 hour of admission. Similar study done by Goldberg<sup>10</sup> et al, in which a total of 105 deaths (10%) occurred within 30 days of admission. 6.2% (44/708) of patients without hyponatremia, 19.8% (26/131) of patients with hyponatremia on admission and 16.8% (35/208) of patients who developed hyponatremia after admission.

#### 5. Conclusion

Hyponatremia has been shown to be a predictor of cardiovascular mortality among patients with heart failure and acute anterior wall MI. In our study we studied the impact of hyponatremia in predicting the short term survival within 30 days, we found higher mortality in hyponatremic patients as well as significant linear relationship between severity of hyponatremia and mortality. We concluded that hyponatremia on admission or early development of hyponatremia in patients with acute ST elevation myocardial infarction is an independent predictor of 30-day mortality. Plasma sodium levels may serve as a simple marker to identify patients at risk.

**Table 1:** Comparative study of group ABC with various variables

Characteristics	Normal sodium level (n=60) A	Hyponatremia on Admission (n=17) B	Hyponatremia within 72 hrs (n=23) C	P value
	Mean $\pm$ SD, Number (%) or Median			
Age (Yrs)	51.8 $\pm$ 12.15	55.8 $\pm$ 10.8	53.71 $\pm$ 9.54	0.413
Male sex	48(60%)	16(20%)	16(20%)	0.16
Diabetes	7(29%)	9(37%)	8(33%)	0.0004
Smoking	24(63%)	7(18%)	7(18%)	0.695
Hypertension	14(56%)	2(8%)	9(36%)	0.1212
Anterior Infarction	48(67%)	12(16%)	12(16%)	0.0039
Killip Class	1.01 $\pm$ 0.12	1.11 $\pm$ 0.33	1.08 $\pm$ 0.28	0.0008
Ejection Fraction (%)	52.95 $\pm$ 9.01	41.1 $\pm$ 10.03	48.9 $\pm$ 10.67	p <0.001

Group A : patients with normal sodium levels

Group B : hyponatremia on admission

Group C: hyponatremia with in 72hours

**Table 3:** Comparative study of group survivors and nonsurvivors for various variables

	Survivors Group A	Non Survivors Group B	T value	P value
N	90	10		
Age (Yrs) ( mean $\pm$ SD)	52.31 $\pm$ 10.9	57.8 $\pm$ 14.5	1.61	0.272
Sex (Male)	75	5	2.55	0.012
Sex (Female)	15	5		
Hyponatremia (mean $\pm$ SD)	136.92 $\pm$ 1.90	134.7 $\pm$ 3.52	3.026	0.0032
Smoking	35	4	0.07	0.945
Diabetes	19	5	2.05	0.0429
Hypertension	20	5	2	0.0484
Infarct site Anterior	65	7	0.137	0.893
Inferior	17	3		
Killip Class I	86	7	2.7	0.0234
Killip Class II	4	3		
EF (%) (mean $\pm$ SD)	49.74 $\pm$ 10.71	40.2 $\pm$ 8.31	2.7	0.008

**Table 2** Showing comparative study of Hyponatremia in various groups like Diabetes ,Mean EF(%) ,Killip class, AWMI in Three study groups(A,B,C)

Groups	Diabetes	Mean EF(%)	Killip class	AWMI
Normalsodium level(A)	29%	52.95 $\pm$ 9.01	1.01	67%
Hyponatremia on admission(B)	37%	41.1 $\pm$ 10.03	1.11	16%
Hyponatremia within 72 hrs(C)	33%	48.9 $\pm$ 10.67	1.08	16%

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