

Effects of Hyponatremia in Patient with Acute Coronary Syndrome

Sanjeev Kumar Dharmesh¹, Archana Gupta², Santosh Singh Yadav³, Kanha Gupta⁴¹PG Student, Department of Medicine, G.R. Medical College & J.A. Group of Hospitals, Gwalior, Madhya Pradesh, India²Professor, Department of Medicine, G.R. Medical College & J.A. Group Hospitals, Gwalior, Madhya Pradesh, India³Associate Professor, Department of Cardiology, G.R. Medical College & J.A Group of Hospitals, Gwalior, Madhya Pradesh, India⁴Medical Student, G.R. Medical College & J.A Group of Hospitals, Gwalior, Madhya Pradesh, India

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Abstract

Introduction - Hyponatremia mostly occur very common in acute coronary syndrome and it is a bad prognostic indicator in patients with acute coronary syndrome. Also hyponatremia is a single independent predictor of adverse clinical outcomes on mortality in hospitalized patients due to severe heart failure¹. In these patients with acute coronary syndrome hyponatremia has been related to the non-osmotic release of ADH, activation of RAS and then leading to catecholamine production. Coronary artery disease is the world's most important cause of death. Electrolyte imbalance is common in hospitalized patients, especially in patients with heart failure. Hyponatremia is also common after myocardial infarction which increases the mortality and but there is very much clinical improvement followed by a rise in plasma Sodium at concentration. Hyponatremia is defined as plasma concentration of <135 mEq/L. **Aim & Objective** - To study the effects of hyponatremia in patients with acute coronary syndrome, To analyse prognostic significance of hyponatremia in patients with acute coronary syndrome. To access usefulness of hyponatremia in predicting short term mortality. To find association between hyponatremia and other risk factor like Ejection fraction, Hypertension, diabetes mellitus, type of infarction. **Methodology** - Prospective study, Study population: 105 patients admitted as acute coronary syndrome. **Inclusion criteria:** 100 clinically diagnosed cases of acute coronary syndrome. Patients with chest pain > 20 min and ST segment elevation in ECG. **Exclusion Criteria:** Patients with renal failure, Diabetic patients, Acute and chronic liver failure, COPD patients on beta agonists. **Results** - Acute coronary syndrome is an important cause of mortality and morbidity in the world. 105 cases of acute coronary syndrome was selected in our study conducted in Gajraraja Medical College, Gwalior, from 2020 to 2022 and was found that hyponatremia was a major prognostic factor in acute myocardial infarction. In my study middle aged population >40 years age are at more risk to developing coronary artery disease. It is relatively a small proportion of all MI. Studies show that 900 people under the age of 30 die every day from heart disease in India. Many risk factors like psychological stress, cocaine use, alcohol, APLA, family history, OCP, hypercoagulable states, etc have been attributed to the cause. In my study, the incidence of male and female were 81 and 24 respectively among the 105 patients. Hyponatremia is well known that it is a serum Sodium at level <135 mEq/L. The severity of hyponatremia was defined as mild(130-135mEq/L) and moderate to severe (<130mEq/L). Serum Sodium at levels were documented as follows: baseline measurement at the day of admission, the lowest Sodium at level during hospitalization i.e after 48 hrs of admission and during discharge. **Conclusion** - On concluding hyponatremia has significant prognostic value in short term and long term adverse events in patients diagnosed with ACS. It is a single predictive factor for prognosis of Acute Coronary syndrome. Prognosis worsen with increasing severity of hyponatremia. As seen in the study, mortality rate was higher with hyponatremia patients, both at admission and discharge. Among the patients in my study hyponatremia was more common in the 6th decade without any previous illness like diabetes mellitus, chronic kidney disease heart failure. The common cause of hyponatremia was ruled out of which acute myocardial infarction was the only cause for hyponatremia in the study population.

Keywords: Acute, hyponatremia

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Introduction

Hyponatremia mostly occur very common in acute coronary syndrome and it is a bad prognostic indicator in patients with acute coronary syndrome. Also hyponatremia is a single independent predictor of adverse clinical outcomes on mortality in hospitalized patients due to severe heart failure. In these patients with acute coronary syndrome hyponatremia has been related to the non-osmotic release of ADH, activation of RAS and then leading to catecholamine

production.

Coronary artery disease is the world's most important cause of death. Electrolyte imbalance is common in hospitalized patients, especially in patients with heart failure. Hyponatremia is also common after myocardial infarction which increases the mortality and but there is very much clinical improvement followed by a rise in plasma Sodium at concentration. Hyponatremia is defined as plasma concentration of <135 mEq/L[1-4]

*Correspondence

Dr. Sanjeev Kumar Dharmesh

PG Student, Department of Medicine, G.R. Medical College & J.A.

Group of Hospitals, Gwalior, Madhya Pradesh, India

E-mail: drsanjeevdharmesh@gmail.com**Acute Coronary Syndrome**

This syndrome includes unstable angina and non-ST segment elevation myocardial infarction (NSTEMI). ACS is a spectrum of disease characterized by either one of the following:

1. New onset angina
2. Angina at rest

- 3. Progression of angina of increasing frequency or severity
- 4. Angina in response to lower levels of exertion

blood sample taken and sent for investigation and the data were entered in the proforma designed for the study.

Materials and Methods of the Study

Study design: prospective study
 Setting: Gajaraja medical college Gwalior. Period of study: 2 year
 Sample size: 105
 Study population: 105 patients admitted as acute coronary syndrome

Inclusion Criteria

100 clinically diagnosed cases of acute coronary syndrome. Patients with chest pain > 20 min and ST segment elevation in ECG.

Exclusion Criteria

Patients with renal failure Diabetic patients
 Acute and chronic liver failure Acute gastroenteritis
 Adrenal insufficiency
 Hypertensive patients on potassium sparing diuretics COPD patients on beta agonists.

Data Collection

After obtaining informed consent, detailed history was taken and

Definitions

Antro septal MI: ST elevation in V1-V4.
 Antro lateral MI: ST elevation in L1, avL, V4-V6
 Extensive anterior wall MI: ST elevation in I, aVL, V1-V6
 Inferior wall MI: ST elevation in LII, III, aVF
 Right ventricular wall MI: ST elevation in V3R, V4R
 Posterior wall MI: There is tall and wide R wave, ST segment depressed and concave upwards, widened and upright T wave in V2.

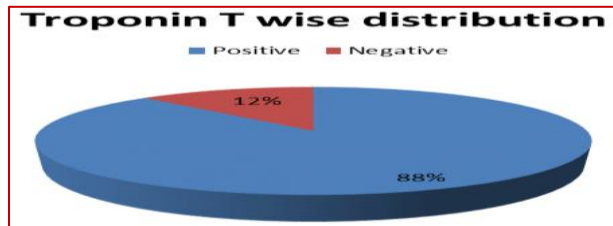
Laboratory Investigations

1. Electrocardiogram
2. Echocardiogram
3. Serum Sodium at Levels
4. Serum Glucose Levels
5. Seum Urea & Creatinine Levels

Plasma Sodium at concentration was measured by using an ISE (Ion Selective Electrode) . Hyponatremia was considered as Sodium at < 135mmol/l.

Table 1: Distribution of study participants based on Troponin T status

Troponin T	Frequency	Percentage (%)
Positive	92	87.6
Negative	13	12.3
Total	105	100.0

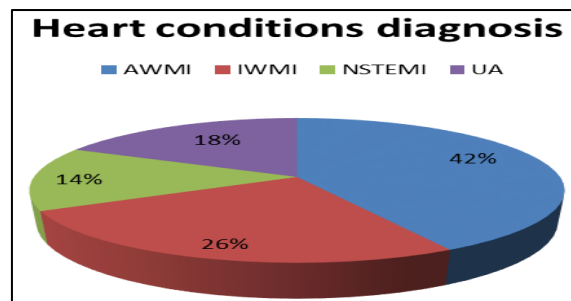


Among the study participants, troponin T status was positive in 87.6% of patients while it was negative in rest because of unstable angina, old myocardial infarction, delay and faulty performing test.

Troponin assay should generally be considered a prognostic, not a diagnostic test and should be used in combination with the patients history and ECG never alone.[5-8]

Table 2: Distribution of study participants on the basis of heart conditions diagnosed

Diagnosis	Frequency	Percentage (%)
AWMI	44	41.9
IWMI	27	25.7
NSTEMI	15	14.3
UA	19	18.1
Total	105	100.0

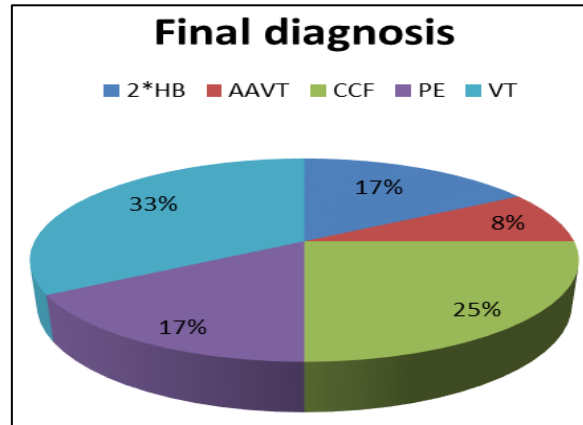


The above table shows the distribution of study participants on the basis of heart conditions diagnosed. AWMI was reported in majority (41.9%) participants, followed by IWMI (25.7%), UA (18.1%) and

NSTEMI (14.3%). LAD supply maximum blood to heart (2/3rd) and more prone to atherosclerotic changes ,therefore AWMI is found more.

Table 3: Distribution of study participants on the basis of final diagnosis

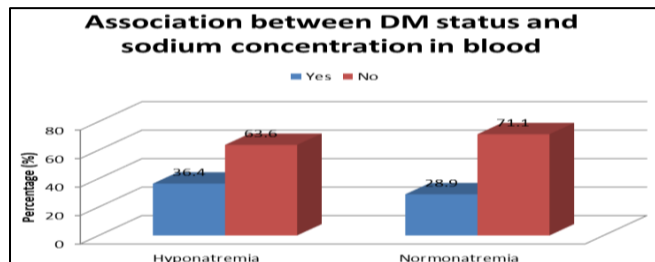
Diagnosis	Frequency	Percentage (%)
2*HB	2	16.7
CCF	3	25.0
PE	2	16.7
VT	5	41.6%
Total	12	100.0



The above table shows the distribution of study participants on the basis of final diagnosis. Majority patients developed VT (41.6%) followed by CCF (25%), and PE and 2*HB with 25%,16.7% and 16.7% respectively.

Table 4: Association between DM status and sodium concentration in blood

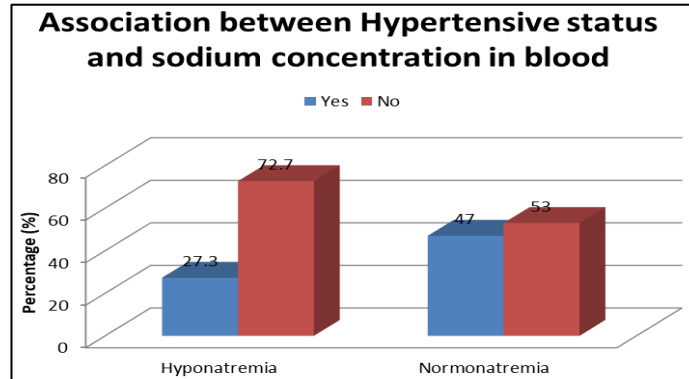
DM	Na		Total	p-value
	Hyponatremia	Normonatremia		
Yes	8 (36.4%)	24 (28.9%)	32 (30.5%)	0.500 (Chi-square test)
No	14 (63.6%)	59 (71.1%)	73 (69.5%)	
Total	22 (100.0%)	83 (100.0%)	105 (100.0%)	



The above table shows the association between DM status and sodium concentration in blood. Diabetes mellitus was present in only 36.4% and 28.9% patients with hyponatremia and normonatremia respectively. Diabetes is an independent risk factor for coronary artery disease but there was no significant association between diabetes melitis and sodium concentration (p value 0.500).[9-12]

Table 5: Association between Hypertensive status and sodium concentration in blood

HTN	Na		Total	p-value
	Hyponatremia	Normonatremia		
Yes	6 (27.3%)	39 (47.0%)	45 (42.9%)	0.097 (Chi-square test)
No	16 (72.7%)	44 (53.0%)	60 (57.1%)	
Total	22 (100.0%)	83 (100.0%)	105 (100.0%)	

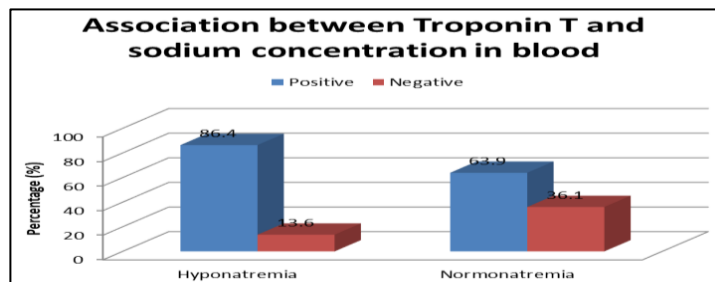


The above table shows the association between hypertensive status and sodium concentration in blood. Only 27.3% and 47.0% of the hyponatremic and normonatremic patients respectively were

hypertensive, while majority were non-hypertensive. HTN was found not significant with sodium concentration (The p-value 0.097).

Table 6: Association between Troponin T and sodium concentration in blood

Troponin T	Na		Total	p-value
	Hyponatremia	Normonatremia		
Positive	19 (86.4%)	53 (63.9%)	72 (68.6%)	0.043 (Chi-square test)
Negative	3 (13.6%)	30 (36.1%)	33 (31.4%)	
Total	22 (100.0%)	83 (100.0%)	105 (100.0%)	

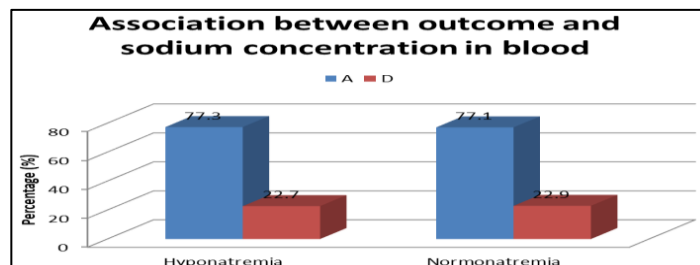


The above table shows the association between Troponin T and sodium concentration in blood. Troponin T was positive in 86.4% patients with hyponatremia and 63.9% patients with normonatremia;

and was negative in the rest. There was significant association found between troponin T and sodium concentration in blood with p value 0.04.

Table 7: Association between outcome and sodium concentration in blood

Follow-up	Na		Total	p-value
	Hyponatremia	Normonatremia		
A	17 (77.3%)	64 (77.1%)	81 (77.1%)	0.987 (Chi-square test)
D	5 (22.7%)	19 (22.9%)	24 (22.9%)	
Total	22 (100.0%)	83 (100.0%)	105 (100.0%)	

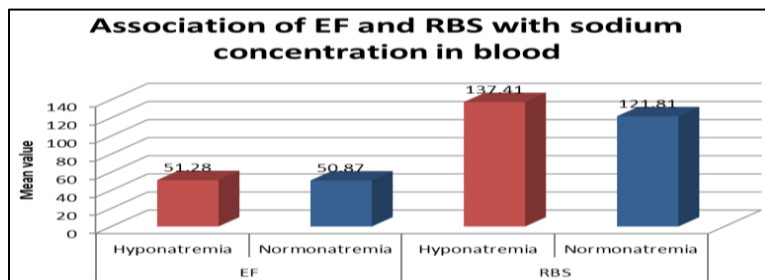


The above table shows the association between the sodium concentration in blood and final outcome. Most of the patients in both the groups (77.3% in hyponatremia and 77.1% in normonatremia

group) survived while the remaining died. The p-value obtained by Chi-square test was found insignificant.

Table 8: Association of EF and RBS with sodium concentration in blood

Variables	Hyponatremia	Normonatremia	t-test value	p-value
	Mean \pm SD	Mean \pm SD		
EF	52.18 \pm 9.44	50.87 \pm 9.55	0.575	0.566
RBS	137.41 \pm 33.68	121.81 \pm 29.98	0.211	0.037



The above table shows the association of EF and RBS with sodium concentration in blood. The mean value of EF among patients of hyponatremia was 52.18 \pm 9.44 and among those with normonatremia was 50.87 \pm 9.55. The p-value obtained was insignificant (0.566).

The mean RBS value was 137.41 \pm 33.68 and 121.81 \pm 29.98 among hyponatremic and normonatremic patients respectively. The p-value was found to be significant (0.037).

Discussion

Acute coronary syndrome is an important cause of mortality and morbidity in the world. 105 cases of acute coronary syndrome was selected in our study conducted in Gajraraja Medical College, Gwalior, from 2020 to 2022 and was found that hyponatremia was a major prognostic factor in acute myocardial infarction.

Age and Myocardial Infarction

In my study middle aged population >40 years age are at more risk to developing coronary artery disease. It is relatively a small proportion of all MI. Studies show that 900 people under the age of 30 die every day from heart disease in India. Many risk factors like psychological stress, cocaine use, alcohol, APLA, family history, OCP, hypercoagulable states, etc have been attributed to the cause.

Sex Predilection in Acute Coronary Syndrome

In my study, the incidence of male and female were 81 and 24 respectively among the 105 patients. The incidence is higher in males as compared to females because

- male are more likely to abuse tobacco ,alcohol and illicit drugs.
- Estrogen will prevent coronary artery disease in female.
- It is male predominant society where medical attention less given to female as compare to male.

Hyponatremia in Acute Coronary Syndrome

Hyponatremia is well known that it is a serum Sodium at level <135 mEq/L. The severity of hyponatremia was defined as mild(130-135mEq/L) and moderate(<130mEq/L). Serum Sodium at levels were documented as follows: baseline measurement at the day of admission, the lowest Sodium at level during hospitalization i.e after 48 hrs of admission and during discharge. Goldberg et al suggested that hyponatremia on admission or shortly thereafter is an independent predictor of short term and long term mortality in STEMI. Klopotoski et al investigated about the in hospital outcomes of Sodium at level on admission in STEMI patients treated with primary angioplasty. We also observed that mortality was found to be increased in patients with hyponatremia in our study there were 22.7% deaths related to hypnatremia and 22.9% death were in normonatremia group. We observed 77.3% patients with hyponatremia who survived and discharged uneventfully. Alexander,C et al showed in their study proved that acute STEMI patients with no evidence of hyponatremia developed mortality rate of 6.2% and patients with hyponatremia on admission had a mortality rate of 19.8% and hyponatremia developed after admission had a

mortality of 16.8%.

Flear CT et al conducted a similar study in patients with acute myocardial infarction and absorbed that when plasma Sodium at was <130mEq/l the mortality was found to be higher in intensive coronary care units.

Flear CT, Hilton P22 in their study in patients who were admitted in a coronary care unit, concluded that the presence of hyponatremia, hypochloroemia, and also uraemia were common in patients who were confirmed to have myocardial infarction. The degree of the infarct correlated with all the above indices. In hospital mortality rates of patients with hyponatremia was higher in their study.

Szatalowicz et al have shown that the presence of AVP is essential for development of hyponatremia and also that AVP levels were detectable in 30 of 37 patients with CHF.

Siggurdson, Swedberg in their study conducted on 55 patients with acute MI have concluded that the sustained neurohormonal activation that follows MI usually occurs in patients in whom there is clinical heart failure and is also related to the magnitude of the myocardium that is damaged, even in patients without heart failure.

Goldberg et al in their study of 978 patients have concluded early hyponatremia is a simple marker of the neurohormonal activation that occurs during acute phase of MI and is a predictor of the long-term mortality.

Rouleau JL et al in their study of 534 patients found that the presence of neurohormonal activation even at the time of discharge from the hospital in post MI patients is also by itself a sign of bad prognosis.

Bogdan et al concluded in his study that presence of hyponatremia is more prevalent in the first 3 days of acute MI.

Kloptowski et al reported that the patients with acute MI develop hyponatremia on admission or within 48 hours of admission usually causing higher mortality rate[13-16]

Conclusion

On concluding hyponatremia has significant prognostic value in short term and long term adverse events in patients diagnosed with ACS. It is a single predictive factor for prognosis of Acute Coronary syndrome. Prognosis wo4sen with increasing severity of hyponatremia.

As seen in the study, mortality rate was higher with hyponatremia patients, both at admission and discharge.

Among the patients in my study hyponatremia was more common in the 6th decade without any previous illness like diabetes mellitus, chronic kidney disease 9r heart failure. The common cause of hyponatremia was ruled out of which acute myocardial infarction was the only cause for hyponatremia in the study population.

The repeated monitoring of serum sodium level will help physician to identify high risk Acute Coronary syndrome patients earlier and they can reduce the risk for a best management.

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