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Hyponatremia as a prognostic indicator in acute myocardial infarction

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Abstract
Background: Every year, myocardial infarction causes more deaths and disabilities than any other disease in the world, and In fact, it is the most prevalent form of a life-threatening chronic illness.
Objectives: To study hyponatremia as a prognostic indicator in acute myocardial infarction
Methods: 100 patients with Acute Myocardial Infarction who were admitted to the ICU and the Department of Internal Medicine. All patients had a 12-lead ECG, with the right sided and posterior leads taken for inferior wall MI. A detailed history was collected, as well as a detailed clinical examination, as well as daily serum electrolytes and ECHO was done. An Ion selective electrode auto analyzer was used to determine the serum sodium concentration (Roche OMNIC).
Results: In our study 64% were males and 36% were females. Males are more prone for ischemic heart diseases. The proportion of Diabetic, Smokers, hypertensives were more among patients with Hyponatremia. anterior wall MI was the most prevalent, followed by inferior wall MI. Killip class I is found in 74% of patients with normal sodium levels compared to 58% in hyponatremia groups, class II in 20% of patients compared to 24% in hyponatremia, class III in 6% of patients compared to 16% of hyponatremia patients, and class IV in 2% of hyponatremia patients whose sodium level was 130 or lower. Patients who developed hyponatremia had a greater mortality rate than those who had normal sodium levels.
Conclusion: Asians are more likely to develop STEMI. The severe the Hyponatremia, the poorer the prognosis. Hyponatremia and a reduced ejection fraction are more common in anterior wall MI patients than those with normal sodium levels.

Keywords: Killip Score, STEMI, hyponatremia, myocardial infarction

Introduction

Coronary artery disease is a leading source of morbidity and mortality in both developing and developed countries. Cardiovascular disease is a significant cause of morbidity and death worldwide [1]. Every year, 3 million people die from sudden cardiac death as a result of an acute myocardial infarction. Cardiovascular disease has been labeled a contemporary epidemic by the World Health Organization (WHO) [2]. Acute Myocardial Infarction (MI), a symptom of coronary heart disease, is a medical emergency with physical, economic, and psychological consequences for humans [3]. With a decrease in infectious disease-related mortality due to faster economic growth and lifestyle changes that promote atherosclerosis, emerging nations, particularly India, are seeing a rise in ischemic heart disease.

Myocardial infarction is a condition in which there is insufficient blood and oxygen flow to a region of the myocardium; it generally develops when there is an imbalance between myocardial oxygen supply and demand. Because a myocardial infarction can occur at any time throughout a person's productive years, it can have serious negative, psychological, and economic consequences [4]. Atherosclerotic disease of an epicardial coronary artery is sufficient to produce a localized decrease in myocardial blood flow and insufficient perfusion of the myocardium supplied by the affected coronary artery is the most prevalent cause of myocardial ischemia. With a decrease in infectious disease-related mortality, rapid economic growth, and lifestyle changes that promote atherosclerosis, emerging nations, particularly India, are projected to see a rise in ischemic heart disease and Acute Myocardial Infractions (AMI) [5]. Given the vast discrepancy in available resources to treat AMI in poor countries, significant efforts are required to enhance community-based primary preventive programs.

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Obesity, insulin resistance, and type 2 diabetes mellitus are all on the rise, and they are all major risk factors for IHD and AMI.

Hyponatremia is a frequent electrolyte condition in hospitalized patients, particularly in those with heart failure, nephrotic syndrome, or cirrhosis. Hyponatremia has been proven to be a risk factor for cardiovascular disease in people with heart failure. Following a MI, hyponatremia is frequent, and clinical recovery is accompanied by an increase in plasma sodium content [6].

However, whereas the predictive value of hyponatremia in chronic heart failure is well established in data, data on the prognostic value of hyponatremia in the setting of acute myocardial infarction are limited [7]. Hyponatremia is more common in the early stages of ST-elevation myocardial infarction and impacts both short and long-term outcomes.

Materials and Methods

Study Design: Retro prospective Observational study

Sample size: 100 patients with Acute Myocardial Infarction who were admitted to the ICU and the Department of Internal Medicine.
Patients were divided into two groups.

Group 1: (Control group): Sodium levels that are normal

Group 2: Sodium levels in the blood are less than 135mEq/L

Observation and Results

Inclusion Criteria
- All cases of acute myocardial infarction in adults (STEMI)

Exclusion Criteria
- Infective endocarditis
- Any rheumatic heart disease history
- Cardiomyopathy
- Old MI
- Hypertensive patients on diuretics

Patients who met the following Inclusion and exclusion were included in the study.
All patients had a 12-lead ECG, with the right sided and posterior leads taken for inferior wall MI.
A detailed history was collected, as well as a detailed clinical examination, as well as daily serum electrolytes and ECHO was done.
An Ion selective electrode auto analyzer was used to determine the serum sodium concentration (Roche OMNIC). Hyponatremia is characterized as sodium levels below 135mEq/L.

Ethical Clearance: Ethical clearance was obtained from the institutional committee prior to the commencement of the study.

Statistical Methods: Statistical tables and charts were used to illustrate the statistical data. For statistical analysis SPSS software version 22 was used.

Table 1: Distribution based on variables

Gender	Group 1 (Na>135)	Group 2 (Na<135)
Male	32(64%)	32(64%)
Female	18(36%)	18(36%)
Age Group		
<40	4 (8%)	4 (8%)
41 to 50	8 (16%)	8 (16%)
51 to 60	12 (24%)	22 (44%)
>61	26 (52%)	16 (32%)
Total	50 (100%)	50 (100%)
Diabetes Mellitus		
Yes	25(50%)	31(62%)
No	25(50%)	19(38%)
Hypertension		
Yes	23(46%)	28(56%)
No	27(54%)	22(44%)
Smoking		
Yes	27(54%)	28(56%)
No	23(46%)	22(44%)

In our study 64% were males and 36% were females. Males are more prone for ischemic heart diseases. In our study majority of cases were in age group of >61. Minimum age was 30, Maximum age was 80.
In group 1: Among patients who had normal sodium levels 50% were Diabetic, 46% were Hypertensive, 54% were Smokers among patients who presented with Hyponatremia on admission. In Group 2: 62% were Diabetic, 56% were Hypertensive, 56% were smokers. The proportion of Diabetic, Smokers, hypertensives were more among patients with Hyponatremia.

Table 2: Distribution based on Type of STEMI

Diagnosis	Group 1 (Na>135)	Group 2 (Na<135)
ALMI	2	2
ASMI	5	3
AWMI	29	34
IPWMI	2	1
IRVMI	2	0
IWMI	10	10
Total	50	50

In our study, anterior wall MI was the most prevalent, followed by inferior wall MI.

Table 3: Distribution based on Ejection Fraction

Ejection Fraction	Group 1 (Na>135)	Group 2 (Na<135)	Total
<50	9	32	41
>51	41	18	59

The Ejection Fraction was lower in patients who were diagnosed with hyponatremia or acquired hyponatremia within 72 hours when compared to individuals with normal sodium levels, which was statistically significant.

Table 4: Distribution based on KILLIP Classification

KILLIP Class	Group 1 (Na>135)	Group 2 (Na<135)	Total
I	37	29	66
II	10	12	22
III	3	8	11
IV	0	1	1

Killip class I is found in 74 % of patients with normal sodium levels compared to 58 % in hyponatremia groups, class II in 20 % of patients compared to 24 % in hyponatremia, class III in 6 % of patients compared to 16 % of hyponatremia patients, and class IV in 2% of hyponatremia patients whose sodium level was 130 or lower.

Table 5: Distribution based on hospital complications

In hospital complications	Group 1 (Na>135)	Group 2 (Na<135)	Total
2*HB	0	2	2
Acute MR	1	1	2
CCF	0	2	2
CHB	0	2	2
PE	2	1	3
Vfib	0	1	1
VT	0	1	1
Total	3	10	13

Patients with hyponatremia had a higher rate of hospital morbidity.

Table 6: Distribution based on Outcomes

Outcome	Group 1 (Na>135)	Group 2 (Na<135)	Total
Alive	40	30	70
Death	10	20	30
Total	50	50	100

Patients who developed hyponatremia had a greater mortality rate than those who had normal sodium levels.

Discussion

According to our results, individuals with acute myocardial infarction who had hyponatremia on admission or developed hyponatremia after admission are in a high risk category. In our study, a significant number of patients with acute myocardial infarction were hyponatremic at the time of admission or acquired hyponatremia shortly after admission. Patients with hyponatremia were more likely to have diabetes, an anterior infarction, a higher Killip class, and a lower ejection fraction. This is consistent with the findings of the Goldberg *et al*. research [9]. Klopotowski *et al*. observed that hyponatremia independently associated with in-hospital mortality in their research of 1858 ST-elevation

MI patients. Hyponatremic patients had a greater risk of in-hospital mortality from a combination of death and heart failure [10].

Our findings are consistent with those of Goldberg *et al*, who found that the degree of hyponatremia increased mortality. When we analyzed the different risk variables and outcomes among survivors and non-survivors, we observed that, in addition to age, gender, diabetes, hypertension, Killip class on admission, and ejection fraction, hyponatremia was a major risk factor in determining death. The multivariate logistic regression analysis included all of the factors that were substantially related with mortality among survivors and non-survivors. Hyponatremia was still a major independent predictor of mortality.

We conclude that the development of hyponatremia is a signal that most likely includes many prognostic variables, such as the severity of left ventricular failure, hemodynamic changes, and the level of neurohumoral activation [11]. It was shown that the development of hyponatremia is a biochemical marker for prognostic significance, i.e., the degree of left ventricular failure, hemodynamic alterations, and neurohumoral activation [12]. As a result, we found in our study that hyponatremia on admission or early development of hyponatremia in patients with acute MI is an independent predictor of 30-day mortality.

Conclusion

Asians are more likely to develop STEMI. The primary risk factors for acute myocardial infarction are smoking, diabetes, hypertension, and hypercholesterolemia. Hyponatremia that develops during admission or within 72 hours of admission has a poor prognosis. The severe the Hyponatremia, the poorer the prognosis. Hyponatremia and a reduced ejection fraction are more common in anterior wall MI patients than those with normal sodium levels.

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