ISSN: 0975-3583,0976-2833 VOL15, ISSUE 08, 2024

ORIGINAL RESEARCH

Hyponatremia and its Prognostic Significance in Acute ST Elevation Myocardial Infarction

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Received: 16 June, 2024 Accepted: 19 July, 2024

Abstract

Introduction: Cardiovascular disease is one of the leading causes of morbidity and mortality across the world. Worldwide, there are 3 million sudden cardiac deaths per year due to acute myocardial infarction.

Aim of the Study: To assess the Hyponatremia and its Prognostic Significance in Acute ST Elevation Myocardial Infarction.

Material and methods: The present Prospective observational study was conducted among patients with acute STEMI admitted to the emergency of Government medical college and Hospital Jammu over a period of one year from November 2019 to October 2020 and total number of 100 patients was taken. Complete Examination Done along with sodium Concentration diagnosed.

Results: Maximum subjects were from the age group of 51-60 years (38%). 77% and 23% were male and female respectively, hence showing male dominancy in our study. Mean Killips score among the subjects with normal sodium, hyponatremia on admission and hyponatremia within 72 hours was 1.03±0.22, 1.22±0.24 and 1.29±0.23 respectively. In our study, mortality was reported among 7% of the subjects. Out of 7 subjects with mortality; 2.89%, 18.18% and 80% of the patients were having normal sodium, hyponatremia on admission and hyponatremia within 72 hrs respectively with statistically significant difference as $p<0.05$.

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: Cardiovascular disease, Hyponatremia, Myocardial Infarction

Introduction

Cardiovascular disease is one of the leading causes of morbidity and mortality across the world. Worldwide, there are 3 million sudden cardiac deaths per year due to acute myocardial infarction[1]. World Health Organization (WHO) has declared cardiovascular disease as a modern epidemic[2]. Cardiovascular disease contributed to 30% of global mortality and 10% of the global disease burden. In 2005, from a total of 58 million deaths worldwide, 17 million were due to cardiovascular disease and, among them 7.6 million were due to coronary heart disease. Myocardial infarction (MI) is one of the five main manifestations of coronary heart

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 08, 2024

disease, namely stable angina pectoris, unstable angina pectoris, MI, heart failure and sudden death[3].

The burden of cardiovascular disease is increasing both in high-income countries and low- and middle-income countries (LMICs) because of ageing populations, but the burden is greater in LMICs because of much larger population sizes and widespread exposure to increasing levels of risk factors such as unhealthy diet, physical inactivity, obesity, tobacco use, diabetes, raised blood pressure and abnormal blood lipids. Often in LMICs there is a lack of information on the role of risk factors[4-5].

Acute Myocardial Infarction (MI), being one of the manifestations of coronary heart disease, is a medical emergency and has physical, economic and psychological effects on human being. With decline in infectious disease related death due to accelerated economic development and lifestyle changes promoting atherosclerosis; developing countries especially India are experiencing a sharp increase in ischemic heart disease and MI. Given the wide disparity of available resources to treat MI in developing countries, major efforts are needed to strengthen primary prevention programs at community level[6].

Myocardial infarction is a condition in which there is an inadequate supply of blood and oxygen to a portion of the myocardium, it typically occurs when there is an imbalance between myocardial Oxygen supply and demand. Because myocardial infarction may strike any individual during the most productive years, it can have profound deleterious, psychological and economic ramifications[7].Obesity, insulin resistance, and type2 diabetes mellitus are increasing and are powerful risk factors for IHD and AMI[8-9].

Therefore, the present Study to assess the Hyponatremia and its Prognostic Significance in Acute ST Elevation Myocardial Infarction.

Material and Methods

The present Prospective observational study was conducted among patients with acute STEMI admitted to the emergency of Government medical college and Hospital Jammu over a period of one year from November 2019 to October 2020 and total number of 100 patients was taken. This study has been approved by the Institutional Ethics Committee of the hospital. Written Informed consent was taken from all the subjects, who were included in the study after explaining to them the nature and purpose of the study.

Inclusion criteria include All acute myocardial infarction patients havingChest pain lasting more than 20 minutes, Diagnostic ECG changes with characteristic ECG alterations consisting of new pathological Q waves or ST segment and T wave changes.Elevated creatinine kinase MB levels or elevated cardiac troponin T levels.

Exclusion criteria was Acute coronary syndrome without ST elevation in ECG, Patients with previous MI, Congestive cardiac failure, Cirrhosis of liver, Nephrotic syndrome, renal failure, patients with chest infection, bronchogenic carcinoma, and patients on diuretics were excluded from the study.Patients who received thrombolytic therapy (tissue type plasminogen activator or streptokinase) were excluded.

Case selection

The data was collected by a preformed structured interviewer-administered questionnaire that was pretested with modifications made prior to its use in the study. The patients were interviewed that requests for the demographic, socioeconomic status, medical history and previous history of taking any medications and supplements. Clinical history included past history of diabetes, hypertension, etc.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 08, 2024

Myocardial infarction

It was diagnosed in the presence of chest pain lasting >20 minutes, diagnostic serial electrocardiographic (ECG) changes with characteristic ECG alterations consisting of new pathological Q waves or ST segment and T-wave changes, and plasma creatinine kinase–MB elevation greater than twice the normal levels or elevated cardiac troponin T levels.

Investigations

The following investigations were done.Complete blood count, Estimation of blood glucose levels, ESR, Cardiac enzymes: CPK-MB or Troponin T, Urine routine: Albumin, sugar and microscopy, Serum Sodium, Lipid profile, Electrocardiography, Echocardiography.

Sodium Concentration

Venous blood samples were drawn at the time of admission before initiation of treatment. All blood samples were processed within 30 minutes of blood collection. For each patient serum sodium concentration were obtained on admission, at 24hrs, 48hrs and 72 hours. The primary end point was all cause mortality in the hospital. Hyponatremia was defined as serum sodium concentration of less than 135mmol/L (<135mEq/L).

Statistical analysis

Data so collected was tabulated in an excel sheet, under the guidance of statistician. The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). For each assessment point, data were statistically analyzed using one way ANOVA. Difference between two groups was determined using chi square test and the level of significance was set at $p < 0.05$.

Results

Maximum subjects were from the age group of 51-60 years (38%) followed by 61-70 years (31%) while minimum subjects were from the age group of 21-30 years (2%) followed 31-40 years (6%).77% and 23% were male and female respectively, hence showing male dominancy in our study.

Table1: Sodium levels among the study subjects according to diabetes& Anterior Infraction.

Category	N	Variables		Chi Square	P value
		N	%		
Diabetes					
Normal Sodium	69	10	14.49	9.83	0.02*
Hyponatremiaon Admission	11	3	27.27		
Hyponatremia within 72hrs	20	9	45		
Anterior Infarction					
Normal Sodium	69	48	69.57	2.81	0.13
Hyponatremia on Admission	11	8	72.27		
Hyponatremia within 72hrs	20	16	80		

*:statistically significant

In our study, diabetes was revealed among 22% of the subjects. Out of 22 diabetic subjects; 14.49%, 27.27% and 45% of the patients were having normal sodium, hyponatremia on admission and hyponatremia within 72 hrs respectively. When sodium level was compared according to diabetes, it was found to be statistically significant as $p<0.05$. Anterior infarction was reported among 72% of the subjects. Out of 72 subjects with anterior

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infarction; 69.57%, 72.27% and 80% of the patients were having normal sodium, hyponatremia on admission and hyponatremia within 72 hrs respectively with statistically insignificant difference as p>0.05 (table 1).

Table 2: Sodium levels among the study subjects according to Killip Class

Category	N	Variables		Annova Test	p value
		Mean	SD		
Killip Class					
Normal Sodium	69	1.03	0.22	3.51	0.04*
Hyponatremia on Admission	11	1.22	0.24		
Hyponatremia within 72 hrs	20	1.29	0.23		
Ejection Fraction(%)					
Normal Sodium	69	45.91	5.41	4.11	0.03*
Hyponatremia on Admission	11	42.02	6.19		
Hyponatremia within 72 hrs	20	39.74	8.27		

Mean Killips score among the subjects with normal sodium, hyponatremia on admission and hyponatremia within 72 hours was 1.03±0.22, 1.22±0.24 and 1.29±0.23 respectively. When sodium level was compared according to mean Killips score, it was found to be statistically significant as p<0.05. Mean ejection fraction (%) among the subjects with normal sodium, hyponatremia on admission and hyponatremia within 72 hours was 45.91±5.41, 42.02±6.19 and 39.74±8.27 respectively. When sodium level was compared according to ejection fraction (%), it was found to be statistically significant as p<0.05 (table 2)

Table 3: Sodium levels among the study subjects according to mortality.

Category	N	Mortality at the end of 30 Days		Chi Square	P value
		N	%		
Normal Sodium	69	2	2.89	8.94	0.009*
Hyponatremia on Admission	11	2	18.18		
Hyponatremia within 72hrs	20	3	80		

*:statistically significant

In our study, mortality was reported among 7% of the subjects. Out of 7 subjects with mortality; 2.89%, 18.18% and 80% of the patients were having normal sodium, hyponatremia on admission and hyponatremia within 72 hrs respectively with statistically significant difference as p<0.05 (table 3).

Discussion

Hyponatremia is a common electrolyte disorder among hospitalized patients, especially in the postoperative period and in patients with heart failure, nephrotic syndrome, or cirrhosis. It is recognized as a predictor of adverse outcomes in hospitalized patients, and its prognostic implications are usually attributed to the severity of the underlying condition (Anderson RJ et al. 1985, Chung HM et al. 1986).Thus, the aim of this study is to evaluate the importance of hyponatremia as a predictor of prognosis in patients with acute STEMI.

In our study, maximum subjects were from the age group of 51-60 years (38%) followed by 61-70 years (31%) while minimum subjects were from the age group of 21-30 years (2%) followed 31-40 years (6%).Kurian S et al. (2017)[10] in their study found mean age of 57.96±11.7, 64.18±13.3 and 56.33±11.38 years among subject's normal sodium, hyponatremia on admission and hyponatremia within 72 hrs respectively. The maximum numbers of patients were in the age group 51–60 years.Out of 100 subjects, 77% and 23%

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 08, 2024

were male and female respectively, hence showing male dominancy in our study.Kurian S et al[10]. (2017) in their study found 80 men and 20 women in their study.

In our study, diabetes was revealed among 22% of the subjects. Out of 22 diabetic subjects; 14.49%, 27.27% and 45% of the patients were having normal sodium, hyponatremia on admission and hyponatremia within 72 hrs respectively. When sodium level was compared according to diabetics, it was found to be statistically significant as $p<0.05$.Similarly, Goldberg A et al[11]. (2004) in their study found that patients who presented with or developed hyponatremia more often had diabetes.In a study by Kurian S et al[10]. (2017), 37% of the subjects were diabetic.

In our study, anterior infarction was reported among 72% of the subjects. Out of 72 subjects with anterior infarction; 69.57%, 72.27% and 80% of the patients were having normal sodium, hyponatremia on admission and hyponatremia within 72 hrs respectively with statistically insignificant difference as $p>0.05$.Similarly, Goldberg A et al[11]. (2004) in their study found that patients who presented with or developed hyponatremia more often had anterior infarction.Kurian S et al[10]. (2017) in their study too reported similar results.

Mean Killips score among the subjects with normal sodium, hyponatremia on admission and hyponatremia within 72 hours was 11.03±0.22, 1.22±0.24 and 1.29±0.23 respectively with statistically significant difference as $p<0.05$ in this study.Goldberg A et al[11]. (2004) in their study found that patients who presented with or developed hyponatremia more often had higher Killip class.Kurian S et al[10]. (2017) in their study too reported similar results.

In the present study, mean ejection fraction (%) among the subjects with normal sodium, hyponatremia on admission and hyponatremia within 72 hours was 45.91±5.41, 42.02±6.19 and 39.74±8.27 respectively. When sodium level was compared according to ejection fraction, it was found to be statistically significant as $p<0.05$.Similarly, Goldberg A et al[11]. (2004) in their study revealed that patients who presented with or developed hyponatremia more often had lower ejection fractions.Kurian S et al[11]. (2017) in their study too reported similar results.

In our study, mortality was reported among 7% of the subjects. Out of 7 subjects with mortality; 2.89%, 18.18% and 80% of the patients were having normal sodium, hyponatremia on admission and hyponatremia within 72 hrs respectively with statistically significant difference as $p<0.05$.Similarly, Goldberg A et al[11]. (2004) in their study reported that 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.

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. Plasma sodium levels may serve as a simple marker to identify patients at risk.

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