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Study of Serum Sodium Levels in Acute Myocardial Infarction: A Cross-Sectional Observational Study at a Tertiary Care Hospital in Ahmedabad (2024-2025)

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Abstract: ***Acute myocardial infarction (AMI) is a leading cause of morbidity and mortality globally. Electrolyte imbalances, particularly sodium disturbances, are frequently observed in AMI patients but often remain underreported. This cross-sectional observational study aimed to evaluate changes in serum sodium levels among AMI patients and investigate correlations with clinical characteristics such as age, sex, smoking status, diabetes, and hypertension. Conducted at a tertiary care hospital in Ahmedabad from January 2024 to January 2025, the study included 120 subjects—60 patients with confirmed AMI and 60 healthy controls. Serum sodium levels were measured within 12 hours of hospital admission using flame photometry. Results showed significantly lower sodium levels in AMI patients compared to controls ($p < 0.001$). Notably, sodium levels were higher in smokers and diabetics, while hypertensive patients had lower sodium levels. Statistically significant sodium reductions were also observed across different age groups and between sexes. The study concludes that hyponatremia is a frequent and significant finding in AMI, and serum sodium estimation may serve as a simple, accessible marker for early identification and risk stratification in AMI patients.***

Keywords: Acute myocardial infarction, Hyponatremia, Serum sodium, Risk factors, Electrolyte imbalance

1. Introduction

Cardiovascular diseases (CVDs) are the leading cause of death globally, with acute myocardial infarction (AMI) being one of the most critical and life-threatening presentations. AMI results from sudden occlusion of a coronary artery, leading to ischemia and necrosis of the myocardial tissue. Early identification, risk stratification, and targeted management are crucial for improving clinical outcomes. While conventional risk factors such as age, sex, smoking, hypertension, and diabetes mellitus have been extensively studied, biochemical markers like serum sodium have received comparatively less attention in the context of AMI.

Sodium, an essential extracellular electrolyte, plays a vital role in maintaining fluid balance, nerve transmission, and muscle function—including myocardial contractility. Alterations in serum sodium levels, especially hyponatremia, have been associated with poor prognostic outcomes in cardiac and critically ill patients [1-3]. The pathophysiology of hyponatremia in AMI is multifactorial and may involve neurohormonal dysregulation, activation of the renin-angiotensin-aldosterone system (RAAS), and inappropriate antidiuretic hormone (ADH) secretion [4-6]. Despite being a simple and cost-effective laboratory parameter, serum sodium is often underutilized in clinical cardiology settings [7, 8].

This study was conceived to systematically evaluate the role of serum sodium levels in AMI, a parameter that is routinely measured but rarely emphasized. Understanding its association with common cardiovascular risk factors and demographic variables may enhance its utility as a potential prognostic biomarker.

Purpose of the Study

The primary purpose of this study is to analyze serum sodium levels in patients presenting with acute myocardial infarction and to determine whether sodium disturbances correlate with known cardiovascular risk factors such as age, gender, smoking, diabetes mellitus, and hypertension. While sodium is commonly measured during hospital admission, its variations and implications in AMI patients are underreported and insufficiently studied. By comparing serum sodium levels between AMI patients and healthy controls, this study seeks to identify whether hypo-or hypernatremia is prevalent in the AMI population and how it might reflect the severity or pathophysiology of myocardial ischemia. Additionally, the study aims to contribute data from an Indian tertiary care context, where epidemiological and metabolic patterns may differ from global norms. The ultimate goal is to explore whether serum sodium can serve

as a cost-effective, early, and readily available biochemical marker to assist in the diagnosis, risk stratification, and possibly prognosis of AMI patients.

Significance of the Study

Understanding sodium alterations in AMI can help in early detection, monitoring, and prognostication of patients.

Aims and Objectives

This study aims to assess serum sodium levels in AMI patients and examine correlations with age, sex, smoking, hypertension, and diabetes.

2. Materials and Methods

This cross-sectional observational study was conducted at a tertiary care hospital in Ahmedabad, India, from January 2024 to January 2025. A total of 120 subjects were included, comprising 60 patients with confirmed acute myocardial infarction (AMI) and 60 healthy individuals as controls. Inclusion criteria encompassed individuals aged over 18 years with a diagnosis of AMI based on ESC/ACC/AHA/WHF criteria, who provided informed consent. Patients were excluded if they were on diuretic therapy or had known pre-existing electrolyte disorders. Blood samples for serum sodium estimation were collected within 12 hours of hospital admission and analyzed using the flame photometry method. Statistical analysis was performed using the Z-test for the difference between two means, with a p-value less than 0.05 considered statistically significant.

3. Results

Table 1: Serum Sodium Levels in Age Groups

Age Group	Control (n=30)	AMI (n=30)	Z-value	p-value
<50 yrs	137.9 ± 3.5 mEq/L	130.8 ± 5.7 mEq/L	4.14	<0.001*
≥50 yrs	136.5 ± 3.4 mEq/L	129.5 ± 4.9 mEq/L	6.99	<0.001*

Table 2: Serum Sodium by Gender

Gender	Control (n=30)	AMI (n=30)	Z-value	p-value
Male	137.2 ± 3.5 mEq/L	130.0 ± 5.8 mEq/L	5.61	<0.001*
Female	136.8 ± 3.5 mEq/L	129.6 ± 4.1 mEq/L	6.35	<0.001*

Table 3: Serum Sodium in AMI With/Without Smoking

Group	Serum Sodium (mEq/L)	Z-value	p-value
AMI Smokers (n=20)	135.5 ± 2.1		
AMI Non- Smokers (n=40)	128.4 ± 4.6	7.24	<0.001*

Table 4: Serum Sodium in AMI With/Without Hypertension

Group	Serum Sodium (mEq/L)	Z - value	p - value
AMI with HTN (n=25)	127.9 ± 5.2		
AMI without HTN (n=35)	130.1 ± 4.7	1.95	<0.05*

Table 5: Serum Sodium in AMI With/Without Diabetes

Group	Serum Sodium (mEq/L)	Z - value	p - value
AMI with DM (n=28)	131.3 ± 5.1		
AMI without DM (n=32)	129.1 ± 4.9	1.67	<0.05*

4. Discussion

The study confirms a significant reduction in serum sodium among AMI patients. Hyponatremia may result from neurohormonal activation, including increased secretion of antidiuretic hormone and activation of the renin-angiotensin-aldosterone system, secondary to decreased cardiac output and systemic hypoperfusion [2, 4, 6]. Interestingly, higher sodium levels in smokers and diabetics may reflect altered metabolic or sympathetic responses [12, 13]. Previous studies have correlated hyponatremia with increased mortality in cardiac patients [1, 3, 5], and our findings reinforce the prognostic utility of serum sodium in AMI.

5. Conclusion

Serum sodium levels are significantly altered in AMI and show associations with common cardiovascular risk factors. Sodium estimation can serve as a simple and useful marker for prognosis in AMI.

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