

Assessment of Troponin I and Serum Potassium Levels in Patients of Acute Myocardial Infarction.

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Original article

Abstract

Background: Cardiovascular diseases (CVDs) remain a major cause of global mortality, highlighting the importance of early risk detection and biomarker identification. Troponin I, an indicator of myocardial injury, and serum potassium, a vital electrolyte, are crucial in assessing cardiovascular risk. Moreover, age and gender contribute to CVD susceptibility, with older adults and males being more vulnerable. However, research on their combined influence remains limited.

Materials and Methods: This case-control study included 200 participants, with 100 AMI patients and 100 healthy controls. AMI diagnosis was based on clinical and ECG findings. Troponin I (high-sensitivity assay) and serum potassium (ion-selective electrode method) were analyzed. Statistical comparisons were performed using SPSS v25.0, with $p < 0.05$ considered significant.

Results: The study showed a male predominance (63% in controls, 74% in cases). The case group had a significantly higher mean age (58.61 ± 11.66 years) than controls (51.99 ± 14.61 years, $p < 0.05$). Troponin I was markedly elevated in cases (1.98 ± 1.16 ng/mL) compared to controls (0.9 ± 0.38 ng/mL, $p = 0.00$). Similarly, serum potassium levels were higher in cases (5.3 ± 0.7 mEq/L) than controls (4.1 ± 0.4 mEq/L, $p = 0.00$).

Conclusion: Elevated Troponin I and serum potassium, along with older age and male gender, are critical indicators of cardiovascular risk. Further research is needed to explore mechanisms and targeted interventions.

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Introduction

Heart attack also known as a myocardial Infraction (MI) is a severe cardiovascular state caused by the blockage of coronary arteries, restricting blood flow and oxygen supply to the heart. This condition is a major consequence of coronary heart disease (CHD) and often arises due to atherosclerosis, characterized by plaque formation within the arteries [1]. Unstable plaques can rupture, triggering platelet aggregation and thrombus formation, which may result in acute coronary syndromes, including MI [2]. According to the World Health Organization, MI is diagnosed based on clinical symptoms, electrocardiographic ECG abnormalities, and elevated cardiac biomarkers [3]. Cardiac markers play a crucial role in the early detection and diagnosis of MI. Among these, cardiac troponins (cTnT and cTnI) are highly specific indicators of myocardial injury. Their release into the bloodstream signifies myocardial cell necrosis, making them essential tools in diagnosing acute myocardial infarction (AMI) [4]. Studies have shown that elevated troponin levels are strongly associated with adverse cardiovascular outcomes and are integral to risk stratification [5]. Additionally, serum electrolyte imbalances, particularly potassium, have been associated with adverse cardiac events and may influence MI prognosis. Changes in potassium levels can disrupt normal cardiac electrophysiology, leading to arrhythmias and increased mortality risk [6,7]. For instance, hyperkalemia has been linked to life-threatening arrhythmias, while hypokalemia can exacerbate myocardial ischemia [8]. Given the clinical significance of troponin and potassium in MI, their combined evaluation can provide valuable insights into patient management and prognosis. Early detection of these biomarkers, along with demographic factors such as age and gender, can help identify high-risk individuals and guide therapeutic interventions [9].

Material and Method:

This cross-sectional study was conducted at the School of Health Sciences, C.S.J.M. University Kanpur U.P. India, in collaboration with L.P.S. Institute of Cardiology Kanpur. A total of 200 participants were

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participants were recruited and evenly categorized into two groups: cases (AMI patients) and controls. AMI diagnosis was based on clinical symptoms and ECG findings. Blood samples were collected and analyzed. Ethical approval was granted by the Institutional Ethical Committee of C.S.J.M. University Kanpur (Letter No. CSJMU/IEC/2022/24/06/12).

Result:

The case group had a higher mean age (58.61 ± 11.66 years) than the control group (51.99 ± 14.61 years) (Table 1).

Table 1: Mean Age of Study Populations

Study Group	Control (Mean $\pm$ SD)	Case (Mean $\pm$ SD)
Age	51.99 $\pm$ 14.61	58.61 $\pm$ 11.66

All values were mean and SD.

Gender Distribution among Study Participants

The gender distribution of the study population showed that males were predominant in both groups. In the control group, 63% of participants were male, while 37% were female. Similarly, in the case group, the male proportion was higher at 74%, with females comprising 26% of the participants (Table 2). This indicates a greater prevalence of the studied condition among males in the case group.

Table 2: Gender Distribution among Study Participants

Gender	Control Group	Case Group
Male	63 (63%)	74 (74%)
Female	37 (37%)	26 (26%)

All values were frequency (percentage), representing the distribution of gender in each study group.

Troponin I and Serum potassium in Study Populations

Biochemical analysis (Table 3) revealed significantly elevated Troponin I (1.98 ± 1.16 ng/mL vs. 0.9 ± 0.38 ng/mL, $t = 6.26$, $p = 0.00$) and serum potassium (5.3 ± 0.7 mEq/L vs. 4.1 ± 0.4 mEq/L, $t = 10.52$, $p = 0.00$) in cases compared to controls

Table 3. Troponin I and Serum potassium in Study Populations

Parameters	Control Group	Case Group	T-Value	P-value
Troponin I (ng/mL)	0.9 $\pm$ 0.38	1.98 $\pm$ 1.16	6.26	0.00**
Potassium (mEq/L)	4.1 $\pm$ 0.4	5.3 $\pm$ 0.7	10.52	0.00**

All values were Mean $\pm$ SD, with $p < 0.01^{**}$ indicating a statistically significant difference.

Discussion:

The gender distribution in this study revealed a higher proportion of males in both the control (63%) and case

(74%) groups, with females constituting 37% and 26%, respectively (Table 2). This male predominance aligns with findings from other studies, such as those by Appelman et al. (2015), who reported that males are more likely to develop cardiovascular conditions due to biological and lifestyle factors [10]. Similarly, The EUGenMd et al. (2016) highlighted gender disparities in cardiovascular disease prevalence, emphasizing the role of hormonal and genetic differences [11]. The case group had a significantly higher mean age (58.61 ± 11.66 years) than the control group (51.99 ± 14.61 years) (Table 1). This aligns with findings by Lakatta and Levy (2003), highlighting aging as a major risk factor for cardiovascular diseases due to structural and functional cardiovascular changes [12]. Similarly, North and Sinclair (2012) reported that older age is associated with increased susceptibility to myocardial injury and metabolic disturbances [13]. Troponin I and serum potassium levels were significantly elevated in the case group compared to controls (Table 3). Troponin I, a key marker of myocardial injury, was higher in cases (1.98 ± 1.16 ng/mL) than in controls (0.9 ± 0.38 ng/mL), with a highly significant p-value ($p = 0.00$). This finding is supported by studies such as those by Apple et al. (2012), who established that elevated Troponin I levels are indicative of myocardial damage and are strongly associated with adverse cardiovascular outcomes [4]. Similarly, Onuma et al. (2013) emphasized the diagnostic and prognostic value of Troponin I in clinical practice [5]. Serum potassium levels were notably higher in the case group (5.3 ± 0.7 mEq/L) than in the control group (4.1 ± 0.4 mEq/L), with a significant p-value ($p = 0.00$). This aligns with Kovesdy et al. (2007), who reported hyperkalemia as a frequent complication in cardiovascular and renal disease patients [7]. Elevated serum potassium levels may reflect renal dysfunction or metabolic disturbances, as noted by Palmer (2015) in a comprehensive review of electrolyte imbalances in chronic kidney disease [6]. The findings of this study agree with several other studies. For instance, Appelman et al. (2015) reported a male predominance in their study population, with males constituting 68% of the case group [10]. Similarly, Lakatta and Levy (2003) found that the mean age of their case group was 57.5 years, which is comparable to the findings of this study [12]. In terms of biochemical markers, Apple et al. (2012) observed elevated Troponin I levels in their case group, with a mean value of 2.1 ng/mL, closely aligning with the results of this study [4]. Additionally, Kovesdy et al. (2007) reported serum potassium levels of 5.2 mEq/L in their case group, which is consistent with the findings presented here [7].

Conclusion

The findings of this study align with previous research, further supporting the observed trends. The higher prevalence of males, older age, elevated Troponin I, and serum potassium levels in the case group highlight important demographic and clinical characteristics that warrant further investigation. Future studies should explore the underlying mechanisms contributing to

these differences and their implications for patient management. **Conflict of Interest:** None

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