

Acute Coronary Syndrome Patient Profile in Emergency Department: A cross-sectional study

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Abstract

Background: Acute Coronary Syndrome (ACS) remains one of the leading causes of high morbidity and mortality worldwide. Psychological factors are considered important contributors to increasing recurrence rates in patients.

Objective: This study aimed to analyze the association between stress, chest pain complaints, electrocardiographic changes, and cardiac enzyme levels.

Methods: A cross-sectional design was employed. A sample of 105 ACS patients presenting to the hospital emergency department was selected using an accidental sampling technique. Variables measured included stress scores, chest pain, electrocardiographic findings, troponin, and CK-MB levels. Data were analyzed using the Spearman rank test and linear regression, with a significance level set at $p < 0.05$.

Results: Stress scores were significantly associated with chest pain ($p < 0.001$), electrocardiographic changes ($p < 0.001$), troponin levels ($p < 0.001$), and CK-MB levels ($p < 0.001$). ECG findings showed that most STEMI patients (68.9%) experienced severe pain. Linear regression analysis indicated that troponin and CK-MB levels were significantly influenced by chest pain ($p < 0.001$).

Conclusions: Stress is positively correlated with chest pain in ACS patients and is reflected in ECG changes and elevated cardiac enzymes (troponin and CK-MB).

Keywords: Acute Coronary Syndrome; Chest Pain; Electrocardiography.

Introduction

Acute Coronary Syndrome (ACS) remains a major cause of morbidity and mortality worldwide over the past decade. Despite advances in risk management, morbidity and mortality rates are still not optimally controlled. To improve ACS prevention and management, it is essential to identify key risk factors that can trigger heart attacks.¹⁻⁴

Stress is recognized as an important risk factor for acute coronary events.⁵⁻⁷ It is a common condition in daily life, with estimates suggesting that in the past two weeks, two-thirds of the population experienced stress, and about 50% reported moderate to high levels.¹ This stress burden is significantly associated with overall health status.⁸

Physiologically, stress induces vasoconstriction, which reduces blood flow.⁹ This reduction in perfusion can precipitate ACS.⁹

Furthermore, impaired microvascular blood flow increases the likelihood of red blood cell entrapment, contributing to vascular occlusion.¹⁰ Although coronary artery occlusion is relatively rare, when it does occur and is not promptly treated, it can lead to life-threatening ACS. Therefore, early detection is crucial to prevent such outcomes.¹¹

Stress experienced by individuals with ACS can trigger heart attacks, with chest pain being the most common presenting symptom.¹² Although chest pain is typical, other symptoms such as nausea, palpitations, and shortness of breath may also occur.¹³ In addition to physical symptoms, biomarker changes are observed in the blood, characterized by elevated levels of cardiac enzymes that indicate myocardial injury, such as troponin and CK-MB (Creatine Kinase Myocardial Band).^{14,15}

This study aimed to analyze the correlation between stress, physical complaints (specifically chest pain), electrocardiographic changes, and alterations in cardiac enzyme levels among patients presenting with ACS in the hospital emergency department.

Methods

Study Design and Sample

This was an observational, cross-sectional study, including ACS patients who come to the emergency department

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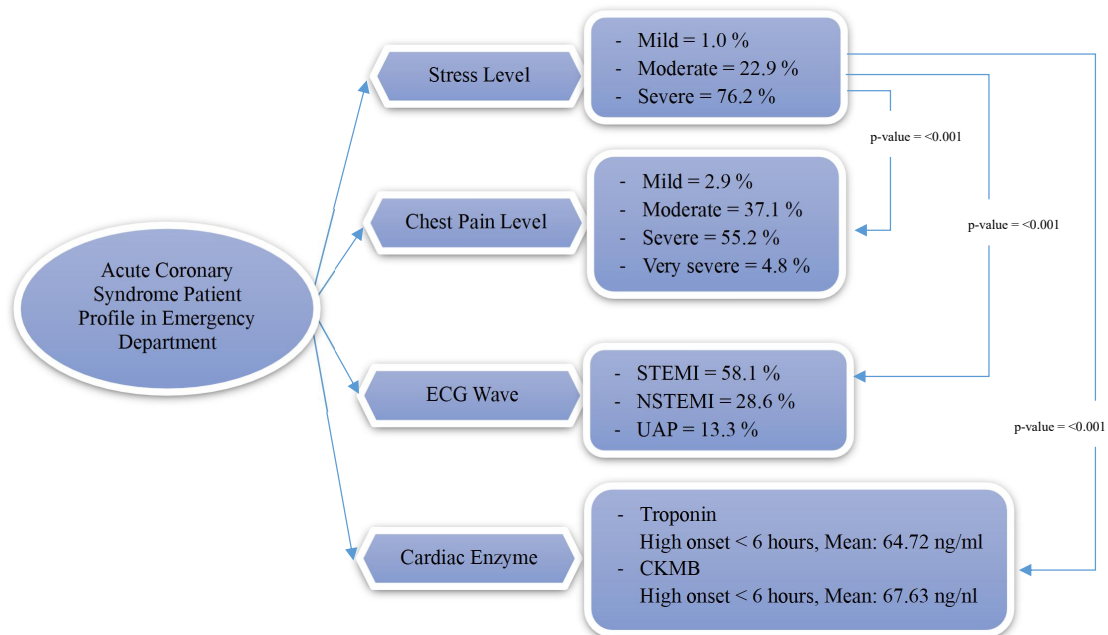
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Central Illustration: Acute Coronary Syndrome Patient Profile in Emergency Department: A cross-sectional study

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Acute Coronary Syndrome Patient Profile in the Emergency Department STEMI: ST-segment Elevation Myocardial Infarction; NSTEMI: Non ST-segment Elevation Myocardial Infarction; UAP: Unstable Angina Pectoris; CKMB: Creatine Kinase Myocardial Band. The p-value ≤ 0.001 for chest pain level, ECG wave and cardiac enzyme indicating a significant correlation between stress level with chest pain level, stress level with ECG wave and stress level with cardiac enzyme.

of hospital X. Samples were taken by accidental sampling technique. The sample size was 105 ACS patients over a six-month period.

Variables, Research Instruments, and Data Collection

The variables measured in this study included the level of stress experienced by patients during the past week, which was suspected to be a contributing factor in the precipitation of heart attacks; complaints of chest pain; changes observed in ECG waveforms; and laboratory results indicating alterations in cardiac enzyme levels, specifically troponin and Creatine Kinase Myocardial Bands (CKMB).

Stress levels were assessed using the Perceived Stress Scale (PSS) questionnaire, which evaluates stress experienced over the past week. Response options consisted of four categories: never (score 1), sometimes (score 2), often (score 3), and always (score 4). Chest pain was measured using a pain scale ranging from 1 (no pain) to 10 (severe pain). Heart rhythm was evaluated using an ECG machine, while troponin and CKMB levels were determined through blood testing.

Prior to conducting the study, the research protocol was approved by the Health Research Ethics Committee of Kanjuruhan General Hospital (approval number: 072.1/EA.KEPK-037/35.07.208/2023). All patients included in the study provided informed consent to participate.

Statistical Analysis

All statistical analyses were conducted in accordance with the Statistical Guidelines of the International Journal of Cardiovascular Sciences. Respondent characteristics were summarized using appropriate descriptive statistics: categorical variables were presented as frequencies and percentages.

Prior to bivariate and multivariate analyses, the distribution of each continuous variable was assessed using the Kolmogorov-Smirnov test to determine normality. Because several variables did not meet the criteria for a normal distribution, Spearman's rank correlation test was applied to evaluate associations between stress level, chest pain intensity, electrocardiographic findings, troponin levels, and CKMB levels.

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To compare differences in cardiac enzyme levels based on symptom onset, the Mann–Whitney U test was used, given the non-normal distribution of the data. Multivariate analysis was performed using linear regression to assess the independent effects of stress, chest pain, and relapse frequency on troponin and CKMB levels.

Before regression analysis, assumptions of linearity, independence of residuals (Durbin–Watson test), homoscedasticity, normality of residuals (histogram and P–P plot), and absence of multicollinearity (tolerance and VIF values) were verified and satisfied.

A two-tailed significance level of $p < 0.05$ was adopted for all analyses. Statistical tests were performed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA).

Result

The results of the study describe the characteristics of the respondents, including general demographic data and the health history of patients with ACS. In addition to respondent characteristics, the study also presents the findings of correlation and multivariate analyses between variables. The characteristics of the 105 respondents in this study are summarized in Table 1.

Table 1 illustrates that ACS patients are predominantly male (79%). The majority of respondents were older than 46 years (92.5%), and more than half (55.2%) were self-employed. Regarding health history, most patients reported a history of smoking (70.5%). Hypertension and diabetes mellitus were the two most common comorbidities, each

Table 1 – Distribution of the frequency of characteristics among acute coronary syndrome patients

No	Characteristics	Frequency (n)	Percentage (%)
Gender			
1	Men	83	79.0
	Woman	22	21.0
No	Respondent Characteristics	Frequency (n)	Percentage (%)
Age			
2	26 – 35 years old	1	1.0
	36 – 45 years old	4	3.8
	46 – 55 years old	30	28.6
	56 – 65 years old	34	32.4
	> 65 years	36	34.3
Work			
3	Housewives	21	20.0
	Employee	26	24.8
	Entrepreneur	58	55.2
Smoking history			
4	Yes	74	70.5
	No	31	29.5
Past Disease History			
5	Hypertension	25	23.8
	Diabetes Mellitus	24	22.9
	Cerebrovascular Accident (CVA)	5	4.8
	Coronary Heart Disease (CHD)	3	2.9
	Anemia	1	1.0
	Hypertension and Diabetes Mellitus	16	15.2
	Hypertension and CVA	4	3.8
	Hypertension and CHD	1	1.0
	None	26	24.8

Frequency of Attacks during the last 12 months			
6	1 time	83	79.0
	2 times	21	20.0
	4 times	1	1.0
Stress Level			
7	Mild	1	1.0
	Moderate	24	22.9
	Severe	80	76.2
Chest Pain			
8	Mild	3	2.9
	Moderate	39	37.1
	Severe	58	55.2
	Very severe/uncontrolled	5	4.8
ECG Wave			
9	ST-Elevation Myocardial Infarction	61	58.1
	Non-ST-elevation myocardial infarction	30	28.6
	Unstable Angina Pectoris	14	13.3

affecting more than 60% of patients. Within the past year, most patients experienced a single heart attack (79%). In the past week, the majority reported severe stress (76.2%). Upon admission to the emergency department with complaints of heart attack, patients most frequently presented with moderate to severe chest pain, and the most common electrocardiographic finding was STEMI (58.1%).

Table 2 shows that the stress score was significantly associated with chest pain, CKMB levels, troponin levels, and ECG findings in ACS patients, with p-values of <0.001 for each variable. In terms of correlation strength, the relationship between stress score and chest pain was very strong ($r = 0.852$). Meanwhile, the correlations between stress score and CKMB levels ($r = 0.390$) and troponin levels ($r = 0.472$) were moderate. The relationship between stress score and ECG findings also demonstrated statistical significance ($p < 0.001$) with a moderate correlation strength ($r = 0.339$). These results are further illustrated in the Central Figure.

Table 3 shows that the chest pain scale was significantly associated with increases in troponin levels, CKMB levels, and ECG findings in ACS patients, with p-values of <0.001 for each variable. In terms of correlation strength, the relationship between the chest pain scale and troponin levels was moderate ($r = 0.443$), while the correlation with CKMB levels was also moderate ($r = 0.501$). The relationship between the chest pain scale and ECG findings demonstrated a weaker, though still significant, correlation ($r = 0.359$).

Table 2 – Results of the Spearman-Rank test of the relationship between stress score and chest pain scale, creatine kinase myocardial band levels, troponin levels and overview of acute coronary syndrome patients' electrocardiogram

Stress Score	Chest pain
	$r = 0.852$
	$p = < 0.001$ $n = 105$
	CKMB Levels
	$r = 0.390$
	$p = < 0.001$ $n = 105$
	Troponin Levels
	$r = 0.472$
	$p = < 0.001$ $n = 105$
	ECG Wave
	$r = 0.339$
	$p = < 0.001$ $n = 105$

Table 3 – Results of the spearman rank test on the relationship between chest pain scale, creatine kinase myocardial band levels, troponin levels, and electrocardiographic findings in acute coronary syndrome patients

Chest Pain Scale	CKMB Levels
	$r = 0.443$
	$p = < 0.001$ $n = 105$
	Troponin Levels
	$r = 0.501$
	$p = < 0.001$ $n = 105$
	ECG Wave
	$r = 0.359$
	$p = < 0.001$ $n = 105$

Based on Table 4, it was found that ACS patients who experienced severe pain and very severe or uncontrolled pain during the electrocardiogram were mostly associated with ST elevation patterns.

Table 5 illustrates that troponin and CKMB levels in ACS patients are affected by chest pain felt by patients (p -value = 0.031; p -value = 0.001). Meanwhile, stress and frequency of recurrence that occurred in patients had no effect on troponin and CKMB levels.

Table 6 shows that both troponin and CK-MB levels were higher at the onset of attacks occurring within 6 hours, with mean rank values of 64.72 and 67.63, respectively. Table 7 demonstrates that troponin and CK-MB levels differed significantly between attack onset within six hours and beyond six hours.

Discussion

In this study, stress experienced by ACS patients in the past month was found to be significantly associated with the chest pain symptoms reported. Moreover, stress was also linked to elevated troponin and CK-MB levels. These findings are consistent with previous studies that identified emotional stress as a factor triggering chest pain in patients with acute myocardial infarction.¹² Other studies have shown that stress increases the intensity of chest pain in patients undergoing cardiac rehabilitation programs.¹⁶ Stress induces ischemia in the heart muscle, and this study further revealed that female patients with a history of myocardial infarction had twice the likelihood of stress-induced myocardial ischemia.¹⁷ This increased risk is attributed to abnormal vasoreactivity and microvascular inflammation in such patients.¹⁸

Patients presenting to the emergency room with chest pain can determine whether the cause is cardiac or non-cardiac by undergoing cardiac enzyme testing. Cardiac biomarkers, particularly troponin, are key indicators that chest pain is of cardiac origin.¹⁹ Ischemia resulting from insufficient oxygen supply to the heart muscle leads to myocardial damage, which can be detected through elevated levels of cardiac enzymes such as troponin I and T.²⁰ This study found that ACS patients had significantly higher troponin levels when the onset of attack occurred within six hours compared to attacks beyond six hours. Similarly, CKMB levels were also significantly elevated in patients with attack onset within 6 hours. These findings suggest that increases in troponin and CK-MB levels are most pronounced during the early hours of a myocardial infarction, serving as important indicators of myocardial injury.

The rise in troponin and CK-MB levels was proportional to the severity of chest pain reported. Patients experiencing severe or uncontrolled chest pain were more likely to show ST elevation on ECG. Acute ST elevation occurs due to coronary artery occlusion, which causes transmural myocardial ischemia and leads to myocardial injury or necrosis.²¹⁻²³ Severe chest pain, often described as intense pressure, burning sensations, or accompanied by shortness of breath, typically reflects acute myocardial infarction. This pain may radiate to the left shoulder, neck, or arm, and can be triggered by stress or physical exertion, though it may also occur without a clear precipitating factor.²² In contrast, patients with NSTEMI or Unstable Angina Pectoris (UAP) more commonly reported moderate chest pain, while NSTEMI patients were also found to experience mild pain.

Conclusion

Stress experienced by ACS patients is significantly associated with chest pain, ECG changes, and alterations in cardiac enzyme levels. Among patients who presented with STEMI patterns on ECG, the majority reported severe chest pain. Chest pain complaints were found to have a significant impact on elevated troponin and CK-MB levels in ACS patients.

The practical implication of these findings is that treatment should be comprehensive, addressing not only the physical symptoms of ACS but also the psychological aspects. Incorporating stress management interventions may help reduce chest pain episodes and improve patient outcomes, with the goal of preventing further myocardial cell damage.

Author Contributions

Conception and design of the research: Fikriana R, Afik A; acquisition of data: Prasetya RE; analysis and interpretation of the data and writing of the manuscript: Fikriana R; statistical analysis and critical revision of the manuscript for intellectual content: Afik A.

Table 4 – Results of the Cross-Tabulation Between Chest Pain Scale and electrocardiographic findings in acute coronary syndrome patients

No	Chest pain	ECG Wave			Total
		NSTEMI n (%)	STEMI n (%)	UAP n (%)	
1	Mild	2 (6.7)	1 (1.6)	0 (0)	3 (2.9)
2	Moderate	16 (53.3)	14 (23.0)	9 (64.3)	39 (37.1)
3	Severe	12 (40.0)	42 (68.9)	4 (28.6)	58 (55.2)
4	Very severe/uncontrollable	0 (0.0)	4 (6.6)	1 (7.1)	5 (4.8)
	Total	30 (100)	61 (100)	14 (100)	105 (100)

“STEMI”: ST-Elevation Myocardial Infarction; “NSTEMI”: Non-ST-elevation myocardial infarction

Table 5 – Effect of stress, pain and frequency of relapse on troponin and creatine kinase myocardial band levels in acute coronary syndrome patients

Variable	Unstandardized Coefficients		Standardized Coefficients	t	p-value
	B	Std. Error	Beta		
Effect on Troponin					
(Constant)	-7.374	2.604		-2.832	0.006
Pain	1.204	0.549	0.346	2.193	0.031
Stress	0.124	0.141	0.140	0.880	0.381
Frequency of Relapse	-0.128	1.013	-0.011	-0.127	0.899
Effect on CKMB					
(Constant)	-20.474	15.696		-1.304	0.195
Pain	10.831	3.311	0.535	3.271	0.001
Stress	-1.006	0,852	-0.195	-1.182	0.240
Frequency of Relapse	3.933	6.101	0.060	0.645	0.521

Table 6 – Distribution of attack onset frequency in relation to troponin and Creatine Kinase–Myocardial Band (CK-MB) levels among acute coronary syndrome patients

Attack Onset	N	Mean Rank
Troponin		
< 6 for him	30	
>6 jam	74	64.72
Total	104	47.55
CKMB		
< 6 for him	30	
>6 jam	74	67.63
Total	104	46.36

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any thesis or dissertation work.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the Kanjuruhan Hospital Ethics Committee under the protocol

number 072.1/EA.KEPK-037/35.07.208/2023. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

Use of Artificial Intelligence

The authors did not use any artificial intelligence tools in the development of this work.

Availability of Research Data

The underlying content of the research text is contained within the manuscript.

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Table 7 – Test results comparing attack onset within 6 hours and beyond six hours in relation to troponin and creatine kinase–myocardial band (CK-MB) levels among acute coronary syndrome patients

	Troponin	CKMB
Mann-Whitney U	743.500	656.000
Wilcoxon W	3518.500	3431.000
With	-2.630	-3.370
p-value	0.009	0.001



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