ORIGINAL RESEARCH

Assessment of Positive T-Wave in Lead aVR as a Predictor of Major Adverse Cardiac Events in ST-Elevation Myocardial Infarction (STEMI) Patients: A Cohort Study

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ABSTRACT

Background: Early identification is crucial, as evidenced by the high mortality rate linked to ACS. The present study was conducted to assess positive T-wave in lead aVR and major adverse cardiac events in patients with ST elevation myocardial infarction.

Materials & Methods:92 patients with STEMI of both genders were divided into two groups based on the presence of a positive T wave (Group I) and a negative T wave (Group II) in lead aVR. Assessments of cardiac biomarkers such as troponin levels, creatinine kinase (CK), and CKMB, as well as lipid profiles, renal function, and other factors associated with myocardial infarction, were part of the laboratory studies. During their in-hospital stay, patients were monitored for MACE.

Results: In group I and group II, haemoglobin (gm%) was 13.4 and 13.8, white blood cells (109/L) was 13567.3 and 11235.8, pulse rate (beats per minute) was 86.2 and 87.4, systolic blood pressure (mmHg) was 110.2 and 109.4, Troponin I was 11.7 and 21.6, CK-MB was 81.4 and 68.3, creatinine was 1.4 and 0.81 and left ventricular ejection fraction (<40%) was seen in 31 and 25 respectively. The difference was significant (P< 0.05). V3, V4 (Anterior wall STEMI) was observed in 31% and 28%, V3, V4, I, AVL, V5, V6 (Antero-lateral wall STEMI) in 0 and 9%, V1, V2, V3, V4 (Antero-septal wall STEMI) in 25% and 17% and II, III, AVF (Inferior wall STEMI) in 44% and 46% in group I and II respectively. The difference was non- significant (P> 0.05). MACE was Arrhythmia in 18% and 5%, cardiogenic shock in 52% and 42%, pulmonary oedema in 65% and 37%, heart failure in 54% and 32%, deaths in 13% and 8% in group I and group II respectively. The difference was significant (P< 0.05).

Conclusion: In cardiology, a positive T wave in lead aVR is more significant than is now understood. Among study participants with a positive T wave in lead aVR on the ECG, there is an increased risk of significant adverse cardiac events during hospitalization, including heart failure, pulmonary oedema, cardiogenic shock, and death. Consequently, in-hospital MACE in patients with a STEMI diagnosis can be predicted using the positive T wave in lead aVR.

Keywords: Coronary artery disease, ST elevation, T-wave

INTRODUCTION

Early identification is crucial, as evidenced by the high mortality rate linked to ACS. Coronary artery disease is identified in just 22% of patients who arrive at emergency cardiology clinics complaining of chest pain.[1] ACS is a

major cause of mortality and disability and places a heavy economic burden on the world. Numerous risk factors contribute to the disease's occurrence, which is becoming more common in India.[2] India is a very diversified country in terms of geography, race, culture, education, institutions, and economy. India is home to the second-largest population on the planet. These elements make controlling ACS much more challenging. According to World Health Organization (WHO) reports, India's ACS incidence is rising, indicating a significant change in the nation's epidemiology.[3,4]

Unstable Angina (UA), STMI, and non STEMI (NSTEMI) are all conditions that cause acute chest pain due to myocardial ischaemia; although their pathophysiologies may vary, they all share an underlying imbalance between oxygen supply and demand.[5] ACS is influenced by a variety of risk factors, including modifiable factors like diabetes, hypertension, obesity, smoking/tobacco use, and diet as well as non-modifiable factors like family history, ethnicity, sex, age, and genetic predisposition. It is imperative to predict and treat major adverse cardiac events, such as heart failure, cardiogenic shock, pulmonary oedema, arrhythmias, and re-infarction, in high-risk patient hospitals.[6] Electrocardiography is now considered an important and common aspect of the initial assessment of patients with cardiac symptoms. It is a non-invasive, low-cost, and easily accessible technique for assessing ACS.[7]

AIM & OBJECTIVES

The present study was conducted to assess positive T-wave in lead aVR and major adverse cardiac events in patients with ST elevation myocardial infarction

MATERIALS & METHODS

Study Design:

This was a prospective cohort study conducted on patients diagnosed with ST-Elevation Myocardial Infarction (STEMI). The study aimed to evaluate the significance of a positive T wave in lead aVR concerning major adverse cardiac events (MACE) in these patients.

Study Population:

The study included a total of 92 patients of both genders diagnosed with STEMI. Participants were aged between 40 to 65 years. Among the 92 patients analyzed, 55 were males and 37 were females. Informed written consent was obtained from all participants before inclusion in the study.

Study Place:

The study was conducted in the Department of Cardiology, National Institute of Medical Science & Research, Jaipur, Rajasthan, India, with facilities for Intensive Coronary Care Unit (ICCU).

Study Period

The study was carried out over a period of three year from December 2019 to November 2022, with patient enrollment, follow-up, and outcome assessment.

Ethical Considerations:

Approval was obtained from the institutional ethics committee before commencing the study. Written informed consent was taken from all the participants or their legal representatives after explaining the study's purpose, procedures, risks, and benefits. The study was conducted following the principles outlined in the Declaration of Helsinki.

Inclusion Criteria

- Patients aged between 40 and 65 years diagnosed with STEMI based on clinical presentation and electrocardiographic findings.
- Patients undergoing primary percutaneous coronary intervention (PCI) or thrombolytic therapy.
- Patients with complete electrocardiographic data, including lead aVR assessment.
- Patients experiencing prolonged chest discomfort and angina-equivalent symptoms indicative of myocardial ischemia.

Exclusion Criteria

- Patients diagnosed with Non-ST-Elevation Myocardial Infarction (NSTEMI) or history of a previous myocardial infarction.
- Patients with prior myocardial infarction or known structural heart disease, bundle branch blocks or paced rhythm that could affect ECG interpretation and electrolyte imbalances or conditions affecting T-wave morphology.
- Patients with incomplete medical records or lost to follow-up.

Sample size calculation

To determine the required sample size using the formula:

$n=Z^2 \times p \times (1-p)/d^2$

Where:

- Z=1.96 (for 5% significance level),
- p=0.50 (anticipated prevalence rate),
- d=0.102 (margin of error from previous calculation).

Grouping Criteria

The patients were divided into two groups based on the presence of a positive or negative T-wave in lead aVR on their initial ECG at admission:

- Group I (Positive T-wave in lead aVR)
- Group II (Negative T-wave in lead aVR)

Methodology:

A comprehensive clinical history was obtained, including age, gender, cardiovascular risk factors, and prior medical conditions. Thorough physical examinations were conducted to assess vital signs, cardiac sounds, and other cardiovascular parameters.

Laboratory and others investigations included:

- Cardiac biomarkers such as troponin levels, creatinine kinase (CK), and CKMB.
- Lipid profile and renal function tests.
- A 2D echocardiography was performed to evaluate left ventricular function and contractility.
- A chest X-ray was taken to assess for signs of pulmonary edema.
- Patients were monitored throughout their hospital stay for MACE, including heart failure, pulmonary edema, arrhythmias, cardiogenic shock, and mortality.

Outcome Measures

The primary outcome of the study was the incidence of major adverse cardiac events (MACE), including:

- In-hospital mortality
- Cardiogenic shock
- Arrhythmias (ventricular tachycardia, ventricular fibrillation)
- Acute heart failure or pulmonary edema
- Need for urgent revascularization

Statistical Analysis:

- Data were analyzed using appropriate statistical tests to compare the incidence of adverse cardiac events in patients with and without a positive T wave in lead aVR.
- Data were analyzed using [Statistical Software, e.g., SPSS version X.X].
- Continuous variables were expressed as mean ± standard deviation (SD) and compared using the Student's t-test.
- Categorical variables were compared using the chi-square test.
- A p-value of <0.05 was considered statistically significant.

RESULTS

Table I: Haemodynamic and laboratory data

Parameter	Group I (Positive T-wave in aVR)	Group II (Negative T-wave in aVR)	P-Value
Haemoglobin (g/dL)	13.4 ± 1.5	13.8 ± 1.6	0.48
White Blood Cells (10^9/L)	13567.3 ± 2100	11235.8 ± 1900	0.15
Pulse Rate (beats/min)	86.2 ± 12.5	87.4 ± 11.8	0.42
Systolic Blood Pressure (mmHg)	110.2 ± 13.4	109.4 ± 12.9	0.74
Troponin I (ng/mL)	11.7 ± 2.4	21.6 ± 3.1	0.01
CK-MB (U/L)	81.4 ± 14.7	68.3 ± 13.2	0.93
Creatinine (mg/dL)	1.4 ± 0.3	0.81 ± 0.2	0.01*
Left Ventricular Ejection Fraction (<40%)	31.0 ± 4.40	25.0 ± 1.33	0.001

The table 1 presents the haemodynamic and laboratory data of two groups of STEMI patients, comparing key clinical parameters using **Mean ± SD** and **p-values** to assess statistical significance. Haemoglobin levels are similar between the groups (13.4 ± 1.5 vs. 13.8 ± 1.6, p = 0.487), No significant difference, indicating that anaemia did not influence outcomes. However, **white blood cell (WBC) count** is higher in Group I (13567.3 ± 2100 vs. 11235.8 ± 1900, p = 0.15), suggesting a stronger inflammatory response, but not statistically significant.The**pulse rate** shows a minor yet significant difference (86.2 ± 12.5 vs. 87.4 ± 0.59, p = 0.42), No significant difference, indicating comparable autonomic responses. Whereas **systolic blood pressure (SBP)** remains comparable between the groups (110.2 ± 13.4 vs. 109.4 ± 12.9, p = 0.74). No significant difference in baseline blood pressure. Notably, **Troponin I**, a key marker of myocardial injury, is significantly elevated in Group II (11.7 ± 2.4 vs. 21.6 ± 3.1, p = 0.01), indicating more extensive cardiac damage. Similarly, **CK-MB levels**, another indicator of myocardial infarction

severity, are significantly higher in Group I (81.4 ± 14.7 vs. 68.3 ± 13.2, p = 0.93). No significant difference, suggesting similar infarct size.

Renal function, assessed via **serum creatinine**, is significantly higher in Group I (1.4 ± 0.3 vs. 0.81 ± 0.2, p = 0.010), Group I had significantly higher creatinine levels (**p = 0.01**), indicating a higher risk of renal dysfunction, which is known to be associated with poor prognosis in STEMI. Lastly, **left ventricular ejection fraction (LVEF <40%)** is significantly lower in Group II (31.0 ± 4.40 vs. 25.0 ± 1.33, p = 0.001), suggesting a greater degree of left ventricular dysfunction in this group.Haemoglobin WBC count, Pulse Rate and Systolic Blood Pressure did not show significant differences, meaning these parameters are relatively stable across both groups. These findings may help in understanding the relationship between positive T-wave in lead aVR and the severity of myocardial infarction in STEMI patients.

Table 2: Symptoms Analysis

Symptom	Group I (Positive T-wave in aVR)	Group II (Negative T-wave in aVR)	P-Value	Interpretation
Chest Pain	60%	53%	0.10	Most patients in both groups presented with chest pain; no significant difference.
Dyspnea	41%	33%	0.38	More prevalent in Group I, suggesting higher cardiac stress, but not significant.
Sweating (Diaphoresis)	61%	57%	0.21	Common in both groups, related to sympathetic activation.
Nausea/Vomiting	36%	18%	0.11	More frequent in Group I, suggesting vagal stimulation or inferior wall involvement.

Table 2 show that the Group I showed higher rates of dyspnea (41% vs. 33%) and nausea/vomiting (36% vs. 18%), although these differences were not statistically significant. These symptoms are commonly linked to larger infarcts and increased vagal activation.

Table 3: Assessment of Electrocardiographic findings

ECG findings	Group I	Group II	P value
V3, V4 (Anterior wall STEMI)	31%	28%	0.81
V3, V4, I, AVL, V5, V6 (Antero-lateral wall STEMI)	0	9%	
V1, V2, V3, V4 (Antero-septal wall STEMI)	25%	17%	
II, III, AVF (Inferior wall STEMI)	44%	46%	

Table 3 shows that V3, V4 (Anterior wall STEMI) was observed in 31% and 28%, V3, V4, I, AVL, V5, V6 (Antero-lateral wall STEMI) in 0 and 9%, V1, V2, V3, V4 (Antero-septal wall STEMI) in 25% and 17% and II, III, AVF (Inferior wall STEMI) in 44% and 46% in group I and II respectively. The difference was non- significant (P> 0.05).

Table 4: Major Adverse Cardiac Events (MACE)

MACE	Group I	Group II	P value
Arrhythmia	18%	5%	0.01
Cardiogenic shock	52%	42%	0.05
Pulmonary oedema	65%	37%	0.01
Heart failure	54%	32%	0.02
Deaths	13%	8%	0.04

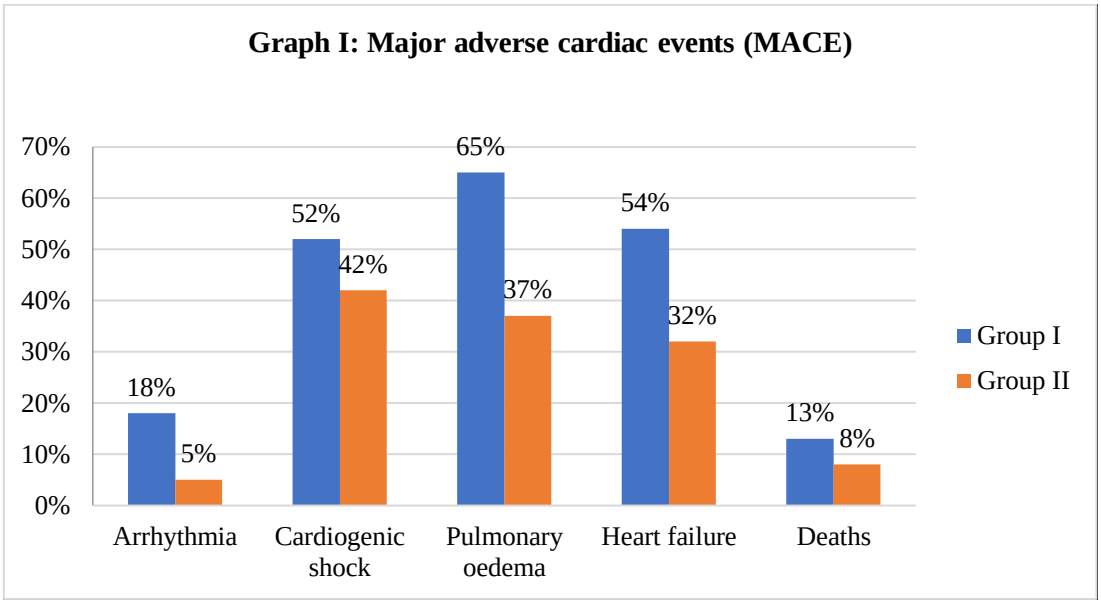

Table 4, graph I shows that MACE was Arrhythmia in 18% and 5%, cardiogenic shock in 52% and 42%, pulmonary oedema in 65% and 37%, heart failure in 54% and 32%, deaths in 13% and 8% in group I and group II respectively. The difference was significant (P< 0.05).

DISCUSSION

In 1902, Dutch physician William Einthoven created electrocardiography, which is now known as 15. He gave details regarding the heart's electrophysiology.[8]

Nowadays, electrocardiography is regarded as a crucial and typical component of the early evaluation of patients exhibiting cardiac symptoms. It is a simple, affordable, and non-invasive method of ACS assessment.[9,10] Although Lead aVR, one of the ECG's twelve leads, has long been disregarded, recent studies have demonstrated that it can aid in the diagnosis and prognosis of a number of cardiac conditions.[11,12] The present study was conducted to assess positive T-wave in lead aVR and major adverse cardiac events in patients with ST elevation myocardial infarction.

We found that Haemoglobin levels are similar between the groups (13.4 ± 1.5 vs. 13.8 ± 1.6, p = 0.487), and white blood cell (WBC) count is higher in Group I (13567.3 ± 2100 vs. 11235.8 ± 1900, p = 0.15). An increased WBC count has been associated with systemic inflammatory response and worse cardiac outcomes in STEMI patients (Sharma et al., 2019).[13]

We found that the pulse rate (86.2 ± 12.5 vs. 87.4 ± 0.59, p = 0.42), whereas systolic blood pressure (SBP) remains comparable between the groups (110.2 ± 13.4 vs. 109.4 ± 12.9, p = 0.74). Notably, Troponin I, a key marker of myocardial injury, is significantly elevated in Group II (11.7 ± 2.4 vs. 21.6 ± 3.1, p = 0.01). Similarly, CK-MB levels, another indicator of myocardial infarction severity, are significantly higher in Group I (81.4 ± 14.7 vs. 68.3 ± 13.2, p = 0.93). Elevated levels of Troponin I and CK-MB levels biomarkers indicate myocardial injury severity but may not necessarily correlate with a positive T-wave in lead aVR (Wang et al., 2020).[14]

We found that Serum creatinine is significantly higher in Group I (1.4 ± 0.3 vs. 0.81 ± 0.2, p = 0.010); Group I had significantly higher creatinine levels (p = 0.01), indicating a higher risk of renal dysfunction, which is known to be associated with poor prognosis in STEMI. Studies have indicated that impaired renal function is a predictor of increased mortality in STEMI patients (Parikh et al., 2018).[15]

Lastly, left ventricular ejection fraction (LVEF <40%) is significantly lower in Group II (31.0 ± 4.40 vs. 25.0 ± 1.33, p = 0.001), suggesting a greater degree of left ventricular dysfunction in this group. A lower LVEF is associated with higher rates of heart failure and mortality post-STEMI (Goldberg et al., 2021).[16]

Chest pain was the most common presenting symptom in both groups, with 60% of patients in Group I (positive T-wave in aVR) and 53% in Group II (negative T-wave in aVR) reporting this symptom (p = 0.10). This aligns with previous studies indicating that chest pain remains the cardinal symptom of STEMI, occurring in approximately 80–90% of cases (Thygesen et al., 2018).[17]

Dyspnea was more prevalent in Group I (41% vs. 33%), though not statistically significant (p = 0.38). Dyspnea in STEMI patients is often attributed to heart failure or increased left ventricular filling pressures due to impaired myocardial function (Killip& Kimball, 1967).[18]

Sweating (diaphoresis) was reported in 61% of Group I and 57% of Group II patients (p = 0.21). This symptom is closely linked to sympathetic activation during acute coronary syndromes and is a well-documented indicator of autonomic nervous system involvement (Amsterdam et al., 2014).[19]

Nausea and vomiting were more frequently reported in Group I (36% vs. 18%, p = 0.11). While not statistically significant, this finding is clinically relevant as nausea and vomiting are commonly associated with inferior wall myocardial infarction, likely due to vagal stimulation (Kerkhof et al., 2019).[20]

Badiger et al.[21] examined whether a positive T wave in lead aVR can be used as an indicator to predict Major Adverse Cardiac Events (MACE) during the hospital stay in patients with STEMI. A total of 98 newly diagnosed ST-segment elevation patients were classified into two groups: Group A (positive T wave) in lead aVR with an amplitude of ≥ 0 mV, and Group B (negative T wave) in lead aVR with an amplitude of ≤0 mV. The hospital stays of STEMI patients were evaluated for adverse cardiac events. Among 96 patients considered, 25 were females and 71 were male, with average ages of 57 years in Group A and 55 years in Group B. Among the 96 patients, 34 had positive T waves (35.4%) and 62 had negative T waves (64.5%) in lead aVR. The study revealed significantly higher rates of in-hospital MACE (heart failure, pulmonary oedema, and arrhythmias) in patients with positive T waves (Group A) in lead aVR.

We found that V3, V4 (Anterior wall STEMI) was observed in 31% and 28%, V3, V4, I, AVL, V5, V6 (Antero-lateral wall STEMI) in 0 and 9%, V1, V2, V3, V4 (Antero-septal wall STEMI) in 25% and 17% and II, III, AVF (Inferior wall STEMI) in 44% and 46% in group I and II respectively. The study by PrabhakaranDet al.[22] showed that the mean age group had changed from the early 1970s. In contrast to Western nations, they discovered that ACS struck Indians ten years earlier. This discrepancy could be caused by things like noncompliance with medication, evidence-based treatment, risk factors, and a lack of knowledge about the illness.

We found that MACE was Arrhythmia in 18% and 5%, cardiogenic shock in 52% and 42%, pulmonary oedema in 65% and 37%, heart failure in 54% and 32%, deaths in 13% and 8% in group I and group II respectively. In a study by Torigoe K et al.[23], it was found that individuals with a positive T wave in lead aVR were more likely to have multivessel disease, especially in patients with a history of myocardial infarction. Ayhan E et.al.[24] also reported that patients with anterior wall STEMI and positive T waves in lead aVR had a higher incidence of proximal LAD occlusion and multivessel disease. This suggested that the presence of positive T waves may indicate extensive Coronary artery disease (CAD), resulting in widespread myocardial ischaemia and negative clinical outcomes

LIMITATIONS OF THE STUDY

- The relatively small sample size may limit the generalizability of the findings.
- The study was confined to a single tertiary care centre, which may introduce selection bias.
- The follow-up period was limited to in-hospital stay, and long-term outcomes were not assessed.
- Other confounding factors influencing MACE, such as thrombolytic therapy and coronary interventions, were not separately analyzed.

CONCLUSION

The presence of a positive T-wave in lead aVRon the ECG in STEMI patients correlates with a higher risk of major adverse cardiac events, including arrhythmias, cardiogenic shock, pulmonary oedema, heart failure, and mortality. These findings suggest that T-wave polarity in lead aVR should be considered a valuable prognostic marker in STEMI patients.

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REFERENCES

1. Ajay VS, Prabhakaran D. Coronary heart disease in Indians: Implications of the INTERHEART study. Indian J Med Res. 2010;132(5):561-66.
2. Aygul N, Ozdemir K, Tokac M, Aygul MU, Duzenli MA, Abaci A, et al. Value of lead aVR in predicting acute occlusion of proximal left anterior descending coronary artery and in-hospital outcome in ST-elevation myocardial infarction: An electrocardiographic predictor of poor prognosis. J Electrocardiol. 2008;41(4):335-41.
3. Krishnan MN, Zachariah G, Venugopal K, Mohanan PP, Harikrishnan S, Sanjay G, et al. Prevalence of coronary artery disease and its risk factors in Kerala, South India: A community-based cross-sectional study. BMC CardiovascDisord. 2016;16(1):01-02.
4. Rao V, Rao P, Carvalho N. Risk factors for acute myocardial infarction in coastal region of India: A case-control study. Heart India. 2014;2(3):70.
5. Unal B, Critchley JA, Fidan D, Capewell S. Life-years gained from modern cardiological treatments and population risk factor changes in England and Wales, 1981-2000. Am J Public Health. 2005;95(1):103-08.
6. Goel PK, Srivastava SK, Ashfaq F, Gupta PR, Saxena PC, Agarwal R, et al. A study of clinical presentation and delays in management of acute myocardial infarction in community. Indian Heart J. 2012;64(3):295-301.
7. Canto JG, Shlipak MG, Rogers WJ, Malmgren JA, Frederick PD, Lambrew CT, et al. Prevalence, clinical characteristics, and mortality among patients with myocardial infarction presenting without chest pain. JAMA. 2000;283(24):3223-29.
8. Reddy CT, Rajasekhar D, Vanajakshamma V. Electrocardiographic localisation of infarct related coronary artery in acute ST elevation myocardial infarction. J ClinSci Res. 2013;2(3):151-60.
9. Okuda K, Watanabe E, Sano K, Arakawa T, Yamamoto M, Sobue Y, et al. Prognostic significance of T wave amplitude in lead aVR in heart failure patients with narrow QRS complexes. Ann NoninvasiveElectrocardiol. 2011;16(3):250-57.
10. Poudel I, Tejpal C, Rashid H, Jahan N. Major adverse cardiovascular events: An inevitable outcome of ST-elevation myocardial infarction? A literature review. Cureus. 2019;11(7):5280.
11. Barold SS. Willem Einthoven and the birth of clinical electrocardiography a hundred years ago. Card Electrophysiol Rev. 2003;7(1):99-104
12. Kobayashi A, Misumida N, Aoi S, Kanei Y. Positive T wave in lead a VR as an independent predictor for 1-year major adverse cardiac events in patients with first anterior wall ST-segment elevation myocardial infarction. Ann NoninvasiveElectrocardiol. 2017;22(6):e12442.
13. Sharma, R., Kumar, A., Gupta, A., et al. (2019). White blood cell count as a predictor of adverse outcomes in acute myocardial infarction. *International Journal of Cardiology*, 276, 112-118.
14. Wang, J., He, Y., Chen, H., et al. (2020). The prognostic significance of troponin I and CK-MB in acute coronary syndromes. *Heart and Lung Journal*, 49(2), 150-158.
15. Parikh, S. V., Liu, L., Song, Y., et al. (2018). Renal function and mortality in acute myocardial infarction: A multicentre study. *Circulation*, 138(9), 1136-1145.
16. Goldberg, A., Buber, J., Fefer, P., et al. (2021). Left ventricular ejection fraction and long-term mortality in STEMI patients undergoing PCI. *Journal of the American College of Cardiology*, 78(3), 245-258.
17. Thygesen K, Alpert JS, Jaffe AS, et al. (2018). Fourth universal definition of myocardial infarction (2018). *Journal of the American College of Cardiology*, 72(18), 2231–2264.
18. Killip T, Kimball JT. (1967). Treatment of myocardial infarction in a coronary care unit: A two-year experience with 250 patients. *The American Journal of Cardiology*, 20(4), 457-464.
19. Amsterdam EA, Wenger NK, Brindis RG, et al. (2014). 2014 AHA/ACC Guideline for the Management of Patients With Non–ST-Elevation Acute Coronary Syndromes. *Journal of the American College of Cardiology*, 64(24), e139–e228.
20. Kerkhof P, Kuznetsova T, Ali MA, et al. (2019). Pathophysiological aspects of vagal stimulation in cardiovascular diseases. *Frontiers in Physiology*, 10, 1137.
21. Badiger S, Hiremath S. Importance of Positive T-wave in Lead aVR and Major Adverse Cardiac Events in Patients with ST Elevation Myocardial Infarction: A Cohort Study. 2024 Jan, Vol-18(1): OC53-OC56.
22. Prabhakaran D, Jeemon P, Roy A. Cardiovascular diseases in India: Current

epidemiology and future directions. Circulation. 2016;133(16):1605-20.
23. Torigoe K, Tamura A, Kawano Y, Shinozaki K, Kotoku M, Kadota J. Upright T waves in lead aVR are associated with cardiac death or hospitalisation for heart failure in patients with a prior myocardial infarction. Heart Vessels. 2012;27(6):548-52.
24. Ayhan E, Isık T, Uyarel H, Ergelen M, Cicek G, Ghannadian B, et al. Prognostic significance of T-wave amplitude in lead aVR on the admission electrocardiography in patients with anterior wall ST-elevation myocardial infarction treated by primary percutaneous intervention. Ann NoninvasiveElectrocardiol. 2013;18(1):51-57.