



Relationship between Tei index and prognosis in patients with non-ST-segment elevation myocardial infarction: A prospective cohort study.

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ABSTRACT

Background:

Non-ST-segment elevation myocardial infarction (NSTEMI) constitutes a diverse subgroup of acute coronary syndromes characterised by inconsistent short-term outcomes. Early prognostic evaluation is crucial for enhancing management techniques. The Tei index, a Doppler-derived myocardial performance indicator, combines systolic and diastolic ventricular function and might provide additional prognostic value.

Objective:

To assess the correlation between the Tei index and in-hospital clinical outcomes in individuals with non-ST-segment elevation myocardial infarction.

Methods:

This prospective cohort research comprised 160 patients diagnosed with non-ST-segment elevation myocardial infarction. Transthoracic echocardiography was conducted within 48 hours of admission to ascertain the Tei index. Patients were monitored during hospitalisation for negative clinical outcomes.

Results:

Greater Tei index values were strongly linked to greater rates of heart failure, arrhythmias, cardiogenic shock, longer hospital stays, and deaths in the hospital. In multivariate analysis, the Tei index was identified as an independent predictor of negative in-hospital outcomes.

Conclusion:

The Tei index is a straightforward, non-invasive echocardiographic metric that autonomously forecasts short-term outcomes in individuals with non-ST-segment elevation myocardial infarction.

Recommendations:

Regular measurement of the Tei index during the initial echocardiographic assessment of patients with non-ST-segment elevation myocardial infarction may enhance risk classification and inform early therapeutic decision-making.

Keywords: Non-ST-segment elevation myocardial infarction; Tei index; myocardial performance index; prognosis; echocardiography

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INTRODUCTION

Non-ST-segment elevation myocardial infarction (NSTEMI) constitutes a significant fraction of acute coronary syndromes and plays a major role in global



cardiovascular morbidity and death [1,2]. In contrast to ST-segment elevation myocardial infarction, NSTEMI demonstrates considerable clinical heterogeneity concerning the degree of ischaemia and myocardial necrosis [3,4]. This diversity makes it harder to make early predictions and choose the best treatment. Risk stratification in NSTEMI often depends on clinical factors, biomarkers, electrocardiography, and established risk scores such as TIMI and GRACE [5,6]. Nonetheless, these instruments may not completely capture early cardiac functional decline, especially in patients with maintained systolic function [7]. Echocardiography is thus essential for a thorough examination of the myocardium [8]. The left ventricular ejection fraction is still the most used echocardiographic predictive indicator. However, it mostly shows systolic performance and may stay the same even if there is a lot of diastolic dysfunction [9,10]. The myocardial performance indicator, known as the Tei index, combines systolic and diastolic time intervals to give a single number that shows how well the ventricles are working [11]. Its considerable independence from heart rate and loading conditions has facilitated prognostic use across many cardiovascular disorders [12-14]. From a pathophysiological perspective, myocardial ischemia leads to prolongation of both isovolumetric contraction and relaxation phases, along with shortening of ventricular ejection time due to impaired contractility and delayed relaxation. As the Tei index incorporates these systolic and diastolic time intervals, it increases proportionally with worsening global myocardial dysfunction, making it particularly sensitive to early ischemic changes seen in NSTEMI [11]. Previous research has established the predictive significance of the Tei index in ST-segment elevation myocardial infarction, correlating increased values with death, heart failure, and unfavourable remodelling [15-17]. Nonetheless, data in NSTEMI is still few, even though diastolic dysfunction is common in this group [18,19]. The current study assesses the prognostic relevance of the Tei index in NSTEMI patients.

METHODOLOGY

Design of the study

Prospective observational cohort research.

Place of study

The research was carried out at the Kalinga Institute of Medical Sciences and Pradyumna Bal Memorial Hospital in

Bhubaneswar, Odisha, India. These are tertiary care teaching hospitals in eastern India that offer a wide range of cardiovascular services to a large number of people.

Participants

A total of 176 patients underwent screening. There were 160 consecutive eligible patients with non-ST-segment elevation myocardial infarction who were enrolled through consecutive sampling.

Variables

The Tei index was the main exposure variable. Heart failure, arrhythmias, cardiogenic shock, longer hospital stays, and death were all possible outcomes.

Sources of data and measurement

Clinical records, laboratory tests, and transthoracic echocardiography done within 48 hours after admission were used to get the data.

Bias

Blinding the echocardiographer to clinical outcomes reduced performance bias. Utilising successive sampling reduced selection bias, and utilising standardised data collection reduced information bias.

Study group

We used a single population proportion calculation to figure out that the sample size of 160 patients would give us a 95% confidence level, a 5% margin of error, and an expected bad outcome proportion from earlier studies.

Analysis of statistics

We used multivariate logistic regression to find factors that could cause bad outcomes on their own.

Ethical considerations

Ethical approval was obtained from the (Approval No: ; dated). Written informed consent was obtained from all participants. (if any)

RESULTS

Baseline Characteristics

The final analysis comprised 160 NSTEMI patients. The average age was 58.4 ± 10.2 years, and 68% of the population was male.



Table 1 Baseline Clinical Characteristics

Characteristic	Total (n=160)	MACE Group (n=38)	Non-MACE Group (n=122)	P-value
Age (years)	58.4 ± 10.2	62.1 ± 9.5	57.2 ± 10.1	0.04*
Male Gender (%)	109 (68%)	28 (73%)	81 (66%)	0.42
Diabetes Mellitus (%)	64 (40%)	22 (58%)	42 (34%)	0.01*
Hypertension (%)	88 (55%)	25 (65%)	63 (51%)	0.12
Smoking (%)	52 (32.5%)	14 (36%)	38 (31%)	0.54
Troponin I (ng/mL)	4.2 ± 3.1	6.8 ± 4.2	3.4 ± 2.1	<0.01*
LVEF (%)	52 ± 8.5	46 ± 9.2	54 ± 7.8	<0.01*

*Statistically significant ($p < 0.05$)

Echocardiographic Findings and Tei Index

The average Tei Index for all participants in the study was 0.48 ± 0.14 . But when stratified by outcome, there was a striking difference. With a p-value of less than 0.001, patients who experienced MACE had a substantially higher

Tei Index (0.64 ± 0.12) than those who did not experience any events (0.42 ± 0.08).

As shown in Table 2, a thorough examination of the particular Doppler time intervals indicates that both a shortening of the Ejection Time (ET) and an extension of the isovolumetric intervals (IVCT and IVRT) contributed to the rise in the Tei Index in the MACE group.

Table 2 Comparison of Echocardiographic Parameters between MACE and Non-MACE Groups

Parameter	MACE Group (n=38)	Non-MACE Group (n=122)	P-value
LVEDD (mm)	51.4 ± 5.2	48.1 ± 4.8	0.03*
LVESD (mm)	38.2 ± 6.1	33.5 ± 5.4	0.01*
IVCT (ms)	62 ± 11	48 ± 9	<0.001*
IVRT (ms)	108 ± 14	78 ± 12	<0.001*
Ejection Time (ET) (ms)	255 ± 22	290 ± 25	<0.001*
E/A Ratio	0.82 ± 0.3	1.1 ± 0.4	0.02*
Tei Index	0.64 ± 0.12	0.42 ± 0.08	<0.001*

It's interesting to note that although 22% of patients in the MACE group had preserved LVEF (>50%), their Tei Index was elevated (>0.55), suggesting that the Tei Index was able to detect subclinical dysfunction that LVEF was unable to detect.

the Curve (AUC) was 0.86 (95% CI: 0.79-0.92), considerably greater than the LVEF's AUC (0.74, 95% CI: 0.65-0.82).

Univariate and multivariate logistic regression analyses were carried out to evaluate the Tei Index's independence as a prognostic indicator. The Tei Index continued to be the most powerful independent predictor of unfavorable outcomes in the multivariate model, despite the fact that age, diabetes, and LVEF were significant in univariate analysis.

Prognostic Correlation

The Tei Index was shown to be a reliable predictor of MACE via ROC curve analysis. The Tei Index's Area Under

Table 3 Univariate and Multivariate Logistic Regression Analysis for Predictors of MACE

Variable	Univariate OR (95% CI)	P-value	Multivariate OR (95% CI)	P-value
Age > 60 years	1.85 (1.1 - 3.2)	0.02	1.42 (0.8 - 2.5)	0.21
Diabetes Mellitus	2.65 (1.4 - 5.1)	0.01	1.95 (0.9 - 4.1)	0.08
LVEF < 45%	3.10 (1.5 - 6.2)	0.01	2.05 (1.1 - 4.3)	0.03*
Troponin I > 5 ng/mL	2.80 (1.3 - 5.8)	0.02	1.88 (0.8 - 3.9)	0.15
Tei Index > 0.55	6.45 (3.1 - 12.8)	<0.001	4.12 (1.8 - 9.4)	<0.001*

OR: Odds Ratio; CI: Confidence Interval. The multivariate analysis was adjusted for age, sex, and cardiovascular risk factors.

The Youden index, a cut-off value of 0.55, was identified. Patients with a Tei Index >0.55 had a significantly higher risk of adverse events.

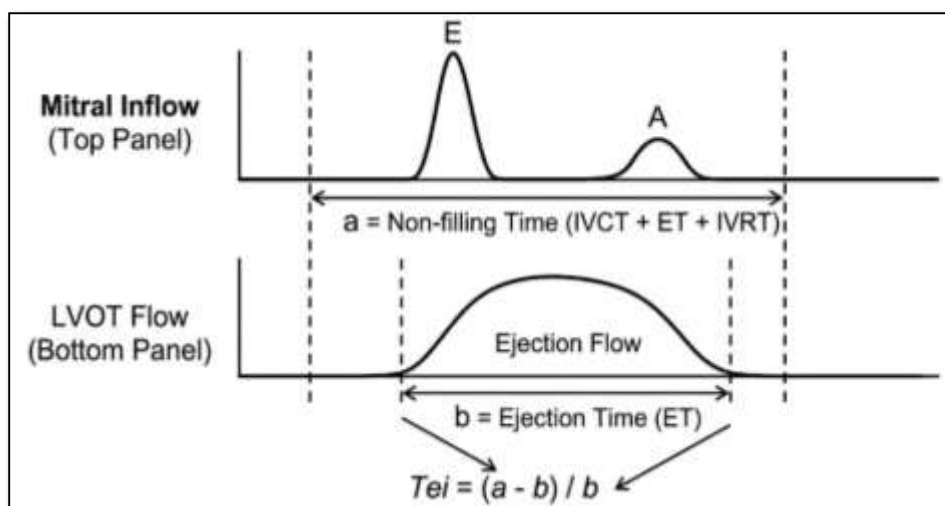


Figure 1 Schematic of the Tei Index Calculation

Kaplan-Meier Survival Analysis

Based on the cut-off, patients were split into two groups: Group A (Tei Index ≤ 0.55) and Group B (Tei Index $>$

0.55). The event-free survival rate was 92% in Group A and only 68% in Group B at the 6-month follow-up (Log-rank test $p < 0.001$).

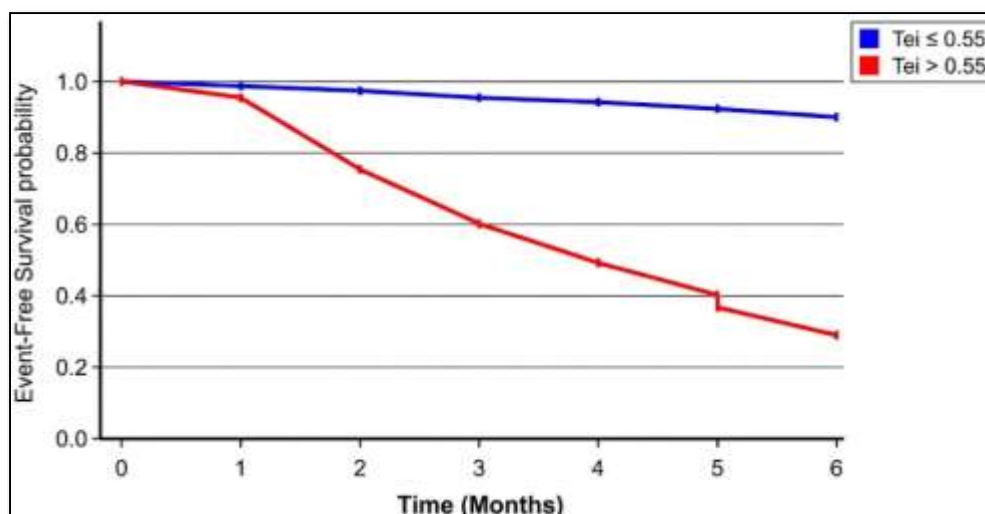


Figure 2 Kaplan-Meier Survival Curve



DISCUSSION

This study shows that high Tei index values are highly linked to bad outcomes in the hospital for NSTEMI patients, which shows how important global ventricular dysfunction is for predicting outcomes [20]. NSTEMI frequently has maintained systolic function, hence constraining the dependence on ejection fraction solely for risk classification [21]. Diastolic dysfunction has a major role in haemodynamic compromise and heart failure during acute coronary syndromes. This shows how important it is to use comprehensive functional indicators [22]. The Tei index, which includes both systolic and diastolic parts, gives more useful information about the future than standard measures [23]. The independent correlation between increased Tei index values and negative outcomes identified in this study corresponds with both classical and modern cardiovascular literature that underscores the necessity of thorough ventricular performance evaluation [24,25]. The regular inclusion of the Tei index in echocardiographic assessments should improve early risk classification in NSTEMI.

CONCLUSION

The Tei index is a strong, non-invasive echocardiographic sign that can predict bad outcomes in the hospital for people with NSTEMI on its own. Regular evaluation of the Tei index could enhance early risk categorisation and inform clinical decision-making.

Limitations

The study has several limitations because it is based on observation. The sample size is statistically adequate, although it originates from a single centre. The Tei Index is less sensitive to loading conditions than LVEF, even though big changes in preload (such as sudden dehydration or volume overload) can still impact intervals. We also did not include patients with atrial fibrillation, which made the results less useful for that group of people.

Recommendations

Routine incorporation of the Tei index into early echocardiographic assessment is recommended.

Data availability

Data are available from the corresponding author upon reasonable request.

Funding

Mention if any

Conflict of interest

The authors declare no conflict of interest.

List of abbreviations

NSTEMI: Non-ST-segment elevation myocardial infarction; LVEF: Left ventricular ejection fraction.

Author contributions

Conceptualization, data collection: Authors; Analysis: Authors; Manuscript drafting and review: Authors.

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