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ORIGINAL ARTICLE

Correlation of Tei Index Assessed by Different Echocardiographic Methods in Patient with Acute Myocardial Infarction Receiving Different Reperfusion Treatment in Comparison with EF and Diastolic Function

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Abstract

Background: **Acute myocardial infarction (AMI) is a common cardiac condition with high morbidity and mortality worldwide. A common complication of AMI is heart failure (HF). HF is the most significant predictor of mortality among AMI patients. So, a significant echocardiographic measurement for post-AMI patient is to assess the left ventricular systolic function via left ventricular ejection fraction (LVEF). As such, Tei index, which simultaneously measures relaxation and contraction velocities, may be of a prognostic importance in those presenting with AMI that may go unmissed with the isolated evaluation of LVEF.**

Objectives: **This work was done to correlate MPI evaluated by different echocardiographic methods in AMI patient receiving different reperfusion treatments.**

Methods: **The was a prospective study which included 60 subjects of both sexes, who were presented to Al-Azhar University Hospitals. They were divided into 2 groups based on the reperfusion strategy, group I that included 31 subjects with 1st attack of acute ST elevation myocardial infarction (STEMI) treated with emergency PCI and group II that included 28 subjects with 1st attack of acute STEMI who underwent fibrinolysis.**

Results: **A highly significant inverse relationship was found between MPI and LV systolic function as the lower the LVEF, the higher MPI and strong correlation between MPI and the killp classification as the higher MPI, the higher the killip class. No significant difference regarding DD, MPI and EF existed in patients presented with acute STEMI and received any one of reperfusion strategies within the first 3 h according to the method of reperfusion. On the contrary, when the time of revascularization was delayed more than 3 h, a significant difference was found in MPI and EF regarding the method of revascularization where primary PCI was better than thrombolytic therapy.**

Conclusions: **MPI and EF is a covariate that is affected by time and method of reperfusion, so in case the time of reperfusion was less than three hours there was no difference according to the method of reperfusion but when the time of reperfusion delayed for more than three hours PCI was much better in decreasing post MI HF or LV dysfunction than thrombolytic therapy strategy.**

Keywords: Left ventricular ejection fraction, Myocardial performance index, Percutaneous coronary intervention, ST elevation myocardial infarction

1. Introduction

AMI is a leading cause of hospital admissions and death globally.[1] The term AMI must be utilized when there is acute myocardial injury with clinical evidence of myocardial ischaemia and with an elevation of Cardiac troponin (cTn) levels with at least one value above the 99th percentile URL and at least one of the following; symptoms of myocardial ischaemia, new ischaemic echocardiographic

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alterations, pathological Q wave, radiological evidence of new loss of viable myocardia or new regional wall motion abnormality in a pattern supporting ischaemia and identification of a coronary thrombus using angiography.[2]

Primary percutaneous coronary intervention (PPCI) and thrombolysis (TL) are two main reperfusion treatments for STEMI. In general, TL is more available and can be initiated faster compared with primary PCI.[3]

Myocardial performance index (MPI) is commonly utilized to assess myocardial functions.[4] It shows more efficacy in the analysis of global cardiac function in comparison with systolic and diastolic measures alone.[5] The MPI, also called (Tei) index, is a simply measurable Doppler-derived index combining systolic and diastolic performance of the myocardium; thus it is reported to be valuable in assessing the outcomes in post- AMI patients.[6] Tei index can be calculated by dividing the Doppler-derived sum of isovolumetric contraction and relaxation by the ejection time. Since Tei index combines all these time intervals, it might be a sensitive measure for the identification of ventricular ischaemia/infarction, which might not show clinical manifestations in routinely performed 2D echocardiography. On this base, we investigated the significance of Tei index for echocardiography assessment of MI.[7] So, the aim of our work was to assess that the Tei index could be a predictor of LV functional outcome in patients with early reperfusion after STEMI and to find out when the index has to be measured.

2. Patients and methods

This prospective study enrolled 60 subjects who were categorized into two groups; 31 cases with 1st attack of STEMI managed with emergency PCI and 28 cases with 1st attack of STEMI managed with fibrinolysis therapy. Both groups were referred to Echo Lab. We included cases with completely occluded Left anterior descending (LAD) coronary artery on coronary angiography and that had successful PCI or successful thrombolysis but we excluded patients who refused examination, patients with bad echocardiographic image, patients with history of prior MI or missed myocardial infarction and patients with other cardiac problems i.e. Atrial fibrillation, Rheumatic heart disease, severe pericardial effusion.

3. Methods

After taking consent from the patients, they were subjected to history taking regarding that included any previous cardiac problems, history of HTN or DM, history of other risk factors. Also they had physical examination inform of cardiac examination, blood pressure measurement and resting 12-lead ECG. Transthoracic 2D Echocardiographic was performed to them to evaluate LVEF by Simpson method, closure to opening time of mitral valve, and aortic valve Ejection time and grade of diastolic dysfunction (Grade I reversed EA pattern, grade II pseudo-normal EA pattern, grade III reversible restrictive pattern and grade VI fixed restrictive pattern) (using GE vivid s5 echo machine). LV systolic function was evaluated with myocardial perfusion imaging after 3 months as a standard for LV function (using IQ-SPECT Siemens healthcare, technetium-99 gamma camera). All the patients were followed-up by echocardiography after 3 months to calculate Tei index and LVEF. All echo Data was digitally stored for later off-line analysis. All patients had myocardial perfusion imaging protocol; inform of two day protocol, and it included in the first day, radioactive material was injected intravenously into the patient blood stream then after 30–40 min LV systolic function was calculated using myocardial perfusion imaging device and in the second day, patient performed treadmill walk till he reached suitable heart rate or he had to stop then radioactive material was injected intravenously and the LV systolic function was calculated again using myocardial perfusion imaging device.

$$\text{LV Tei index (MPI)} = \frac{\text{IVCT} + \text{IVRT}}{\text{LVET}} = \frac{\text{MCOT} - \text{LVET}}{\text{LVET}}$$

* IVCT: iso-volumic contraction time.
* IVRT: iso-volumic relaxation time.
* LVET: LV ejection time (ms).
* MCOT: mitral valve closure to opening time.
* LV MPI: LV myocardial performance index; (Normal range = 0.39 ∓ 0.05 & Dilated cardiomyopathy = 0.59 ∓ 0.10)

3.1. Statistical analysis

Data were analyzed by SPSS. The median and range were used to represent non-parametric data, whereas the mean and standard deviation were used to represent quantitative parametric data. Qualitative data was represented as number and percentage. Data were handled using independent sample *t*-test, Mann-Whitney *U* test and Chi-square tests for statistical analysis. The independent variables in patients with MAC and CAD were determined using multivariate logistic regression analyses. Statistical significance of a result was set at P value ≤ 0.05.

4. Results

This prospective study enrolled 60 Patients that were categorized into 2 groups; group I included 31 cases with 1st attack of STEMI who underwent emergency PCI while group II included 28 cases with 1st attack of STEMI who received fibrinolysis therapy, the mean age in group I was 57.13 ± 13.75years, group II was 51.32 ± 11.67 years. No statistically significant difference as regard the age was found between both groups. There were 22 males (71.0%) and 9 females (29%) in group I compared with19 males (67.9%) and 9 females (32.1%) in group II with no significant difference as regard the gender distribution between the two groups. The mean body mass index in group I was 28.17 ± 3.74, while in group II, it was 28.98 ± 3.82 (Table 1).

Regarding risk factors, no significant difference existed between both groups as regards Hypertension, DM, dyslipidaemia and smoking status. No statistically significant difference as regard the killip class was reported between both groups. No statistically significant difference as regard the hemodynamic state of the patients between the 2 groups. Regarding to time to revascularization: mean time in group I was 9.26 ± 6.20 (5 patient <3 h and 26 patients >3 h), group II was 5.77 ± 2.99 (8 patient <3 h and 20 patients >3 h). A non-statistically significant difference regarding the number of patients treated before and after 3 h between groups. Regarding to diastolic dysfunction (DD), in group I there were 11 patients with grade I DD, 13 patients with grade II DD, 7 patients with grade III DD, and no patients with grade IV DD, while in group II 12 patients with grade I DD, 7 patients with grade II DD, 8 patients with grade III DD, and one patient with grade IV DD. No statistically significant difference as regarding the grade of diastolic dysfunction was found between both groups (Table 2).

Table 1. Comparison between study groups as regards the mean age, gender and MBI.

Demographic data	PCI Group (*n* = 31)	TT Group (*n* = 28)	Test value	*P* value
Age (years)				
Mean ± SD	57.13 ± 13.75	51.32 ± 11.67	$t = 1.739$	0.087
Range	30–85	29–78		
Sex				
Female	9 (29.0%)	9 (32.1%)	$x^2 = 0.067$	0.796
Male	22 (71.0%)	19 (67.9%)		
BMI [wt/ht^2]				
Mean ± SD	28.17 ± 3.74	28.98 ± 3.82	$t = -0.814$	0.419
Range	22–38	22.9–36		

Using: P value, P value comparing the 2 groups; PCI Group, patient done primary PCI as a method of revascularization; t-Independent Sample t-test; TT Group, patient received fibrinolysis therapy as a method of revascularization; X^2, Chi-square test; P value > 0.05 NS.

A non-statistically significant difference was found between both groups regarding EF% by echocardiography, Mitral closure-opening time by pulsed wave Doppler, and TEI index (Table 3).

While the comparison between pre and after 3 months of revascularization between both groups, a significant difference was found in EF% by echocardiography, in Mitral closure-opening time by pulsed wave doppler and in Ejection time pulsed wave doppler ($P < 0.05$) (Table 4).

A non-significant difference was revealed between both groups regarding Ejection fraction percentage by myocardial perfusion imaging ($P > 0.05$) (Table 5).

There was significant correlation between TEI index and pre vascularization regarding SBP, DBP, HR, Time to revascularization, Ejection time pulsed wave doppler, and Ejection fraction% by myocardial perfusion imaging, also there was significant correlation between TEI index and 3 months after vascularization regarding DBP, HR, Time to revascularization, EF% by echocardiography, Ejection time pulsed wave doppler, Difference Ejection time pulsed wave doppler and Ejection fraction% by myocardial perfusion imaging in group PCI (Table 6).

A significant relation existed between TEI index and pre vascularization regarding HR, EF% by echocardiography, Time to revascularization, and Ejection fraction% by myocardial perfusion imaging, also there was significant relation between TEI index and 3 months after vascularization regarding HR, Time to revascularization, EF% by echocardiography, Mitral closure-opening time by pulsed wave doppler, Difference Ejection time pulsed wave doppler and Ejection fraction% by myocardial perfusion imaging. The relation between TEI index and the difference between vascularization was significant regarding SBP only in group TT (Table 7).

5. Discussion

MI is still the commonest cause of HF globally. HF has been reported as a predictor of poor prognosis post-MI for nearly 50 years, however the translation of efforts to promote myocardial repair into clinical therapy has failed.[8] Although PPCI has improved early survival following AMI, its effect on the incidence of downstream HF is still being questioned.[8] When carried out in a timely manner, PPCI is favoured versus fibrinolysis as a reperfusion strategy in

Table 2. Comparison between the study groups in terms of risk factors, killip class, hemodynamic state, revascularization, and grade of diastolic dysfunction.

	PCI Group ($n = 31$)	TT Group ($n = 28$)	Test	P value
Risk factors				
DM	9 (29.0%)	12 (42.9%)	$x^2 = 1.227$	0.268
HTN	16 (51.6%)	8 (28.6%)	$x^2 = 3.237$	0.072
Dyslipidemia	15 (48.4%)	9 (32.1%)	$x^2 = 1.609$	0.205
Smoking	18 (58.1%)	15 (53.6%)	$x^2 = 0.120$	0.728
Obesity	8 (25.8%)	13 (46.4%)	$x^2 = 1.899$	0.168
Killip Class				
I	18 (58.1%)	15 (53.6%)		
II	9 (29.0%)	4 (14.3%)	$x^2 = 4.254$	0.235
III	2 (6.5%)	3 (10.7%)		
VI	2 (6.5%)	6 (21.4%)		
Hemodynamic State				
SBP (mm Hg)				
Mean ± SD	125.32 ± 27.26	121.25 ± 35.61	U = −0.069	0.945
Range	70–165	60–180		
DBP (mmHg)				
Mean ± SD	80.97 ± 18.77	75.71 ± 25.67	U = −0.793	0.428
Range	40–105	30–115		
HR (beat/min)				
Mean ± SD	84.65 ± 16.54	91.46 ± 17.78	t = −1.526	0.133
Range	46–120	55–125		
revascularization				
Time to revascularization (hrs.)				
Mean ± SD	9.26 ± 6.20	5.77 ± 2.99	U = −2.072	0.038*
Range	1–24	1–11		
Time Revasc C				
≤3	5 (16.1%)	8 (28.6%)	$x^2 = 1.326$	0.250
>3	26 (83.9%)	20 (71.4%)		
Grade of diastolic dysfunction				
I (reversed E/A ratio)	11 (35.5%)	12 (42.9%)		
II (pseudo normal)	13 (41.9%)	7 (25.0%)	2.765	0.429
III (restrictive pattern)	7 (22.6%)	8 (28.6%)		
IV	0 (0.0%)	1 (3.6%)		

Using: DM, Diabetes mellitus; HTN, Hypertension; X^2, Chi-square test; U = Mann-Whitney test; P value > 0.05 NS; *P value < 0.05 S.

STEMI.[9] However, logistical issues decrease the availability of PPCI for most of cases around the world. In these cases, fibrinolysis is still the standard treatment.[10] In these patients, fibrinolysis followed by rapid transfer to a PCI-capable hospital to perform either rescue PCI if fibrinolysis has failed or coronary angiography and PCI after successful fibrinolytic treatment is a feasible option.[11] Although the MPI is not commonly utilized in clinical practice to assess cardiac function, there is evidence that it is a simple, reliable, and repeatable measurement among cases with HF, congenital heart diseases, and cardiac rejection post-transplantation.[12] This study was intended to correlate MPI evaluated by echo method in patient with AMI receiving different reperfusion strategies.

The study was carried out on 60 subjects of both sexes, who were presented to Al-Azhar University Hospitals. Subjects were categorized into 2 groups according to the reperfusion strategy, group I included 31 cases with 1st attack of STEMI treated with emergency PCI and group II included 28 cases with 1st attack of STEMI receiving fibrinolytic therapy, the mean age in group I was 57.13 ± 13.75years, in group II was 51.32 ± 11.67years. No significant difference as regard the age was reported between both groups.

Voon et al. (2005) failed to support the tissue Doppler MPI recorded at the mitral annulus as a reliable alternative for traditional MPI of the LV as a non-invasive indicator that combines systolic and diastolic functions of the myocardium.[13] The traditional Doppler MPI is a preload-dependent measurement and the loading state must be considered during its application for the assessment of myocardial performance.

In this study, there was also a highly significant inverse relationship between MPI and LV systolic function both measured by echo and by myocardial perfusion imaging as the lower the LVEF, the higher MPI.

Table 3. Comparison between the study groups at time of revascularization.

	PCI Group ($n = 31$)	TT Group ($n = 28$)	Test value	P value
Pre-Revascularization				
EF% by echocardiography				
Mean ± SD	44.10 ± 10.00	41.25 ± 11.75	U = −1.102	0.270
Range	27–60	25–63		
Mitral closure-opening time by pulsed wave doppler				
Mean ± SD	396.03 ± 24.25	411.50 ± 37.86	t = −1.887	0.064
Range	362–446	321–464		
Ejection time pulsed wave doppler				
Mean ± SD	258.81 ± 19.14	263.82 ± 21.81	t = −0.941	0.351
Range	228–299	213–308		
Myocardial performance index (TEI index)				
Mean ± SD	0.53 ± 0.08	0.56 ± 0.09	t = −1.315	0.194
Range	0.4–0.68	0.38–0.66		
After 3 months				
EF% by echocardiography				
Mean ± SD	44.35 ± 9.38	43.14 ± 10.76	0.462	0.646
Range	30–62	28–65		
Mitral closure-opening time by pulsed wave doppler				
Mean ± SD	413.35 ± 24.50	423.82 ± 37.79	−1.274	0.208
Range	378–464	340–499		
Ejection time pulsed wave doppler				
Mean ± SD	268.42 ± 22.27	270.18 ± 20.64	−0.314	0.755
Range	230–311	221–316		
Myocardial performance index (TEI index)				
Mean ± SD	0.54 ± 0.09	0.57 ± 0.08	−1.000	0.322
Range	0.39–0.66	0.37–0.66		

Using: t-Independent Sample *t*-test; U = Mann-Whitney test, I value > 0.05 NS.

Table 4. Comparison between the two group's difference between pre and after 3 months.

Difference between Pre and After 3 months	PCI Group *(n = 31)*	TT Group *(n = 28)*	*U* test	*P* value
EF% by echocardiography				
Mean ± SD	0.26 ± 3.11	1.89 ± 2.44	−2.102	0.036*
Range	−5–6	−4–5		
Mitral closure-opening time by pulsed wave doppler				
Mean ± SD	17.32 ± 17.84	12.32 ± 15.35	−2.090	0.037*
Range	−42–40	−25–38		
Ejection time pulsed wave doppler				
Mean ± SD	9.61 ± 11.19	6.36 ± 11.53	−2.242	0.025*
Range	−29–26	−26–27		
Myocardial performance index (TEI index)				
Mean ± SD	0.012 ± 0.031	0.006 ± 0.026	−0.644	0.520
Range	−0.05–0.08	−0.08–0.08		

Using: U = Mann-Whitney test, *P* value > 0.05 NS; **P* value < 0.05 S.

Abuomara et al. (2018) Reported that MPI and EF were significant predictors of the occurrence of in-hospital HF ($P = 0.0001$), as MPI was significantly higher among cases that had in-hospital HF (Killip class _ II) in comparison with those without HF (Killip class I); 0.88 ± 0.18 and 0.58 ± 0.11 respectively.[14] So, our work has been clarified that MPI is a good predictor of HF among STEMI cases. In agreement with our result, Goroshi and Chand (2016) demonstrated that MPI negatively associated with systolic dysfunction (rho = 0.455, $P < 0.001$).[15] Sasao et al. (2004) reported that the MPI was correlated with infarction size and might be a strong predictor of the outcome among AMI cases that were successfully treated with primary angioplasty.[16] Biomy et al. (2016) Found that MPI was significantly higher among complicated cases as compared with non-complicated cases in hospital (*p*

Table 5. Comparison between the two groups as regards Ejection fraction % by myocardial perfusion imaging.

Ejection fraction % by myocardial perfusion imaging	PCI Group *(n = 31)*	TT Group *(n = 28)*	*t*-test	*P* value
Mean ± SD	44.35 ± 9.38	43.14 ± 10.76	0.462	0.646
Range	30–62	28–65		

Table 6. *Correlation between myocardial performance index (TEI index) [pre, after 3 months and difference] and different parameter for group PCI.*

Parameters	Pre-Myocardial performance index (TEI index)		After 3 months Myocardial performance index (TEI index)		Difference Myocardial performance index (TEI index)	
	Rs-value	P value	Rs-value	P value	Rs-value	P value
Age (years)	−0.255	0.166	−0.329	0.071	−0.081	0.665
BMI [wt/(ht)^2]	0.171	0.358	0.249	0.176	0.333	0.067
SBP (mmHg)	−0.368*	0.041	−0.165	0.374	0.264	0.151
DBP (mmHg)	−0.590**	0.000	−0.434*	0.015	−0.019	0.917
HR (beat/min)	0.391*	0.030	0.396*	0.028	0.255	0.167
Time to revascularization (hrs.)	0.613**	0.000	0.667**	0.000	0.400*	0.026
EF% by echocardiography	−0.848**	0.000	−0.840**	0.000	−0.475**	0.007
Mitral closure-opening time by pulsed wave doppler	0.216	0.244	−0.067	0.719	−0.194	0.295
Ejection time pulsed wave doppler	−0.554**	0.001	−0.683**	0.000	−0.359*	0.047
Difference EF % by echocardiography	0.346	0.057	0.276	0.133	0.091	0.628
Difference Mitral closure-opening time by pulsed wave doppler	0.058	0.756	0.242	0.189	0.513**	0.003
Difference Ejection time pulsed wave doppler	−0.185	0.320	−0.415*	0.020	−0.409*	0.022
Ejection fraction % by myocardial perfusion imaging	−0.801**	0.000	−0.840**	0.000	−0.457**	0.010

Using: Spearman's rank correlation coefficient (rs), P value > 0.05 NS; *P value < 0.05 S; **P value < 0.001 HS.

0.001). In addition, it was significantly higher among complicated cases compared with non-complicated cases after 3 months (p 0.001).[17] In a study of 85 patients, Kuwahara et al. (2006) reported that increased MPI suggested inadequate coronary reperfusion in those with first attack of anterior AMI without other lesion.[18]

In our study, there was no relationship between diastolic dysfunction and LV MPI which obtained by conventional pulsed wave (PW) Doppler. Consistent with our results, Fernandes et al. (2019)[19] reported that PWD-MPI and TDI-MPI demonstrated poor clinical agreement and were unreliable in the evaluation of LV diastolic function. While Goroshi and Chand (2016) who evaluated cardiac function in 60 diabetic patients; concluded thatMPI as a single parameter could be utilized for evaluation of global biventricular dysfunction in diabetes where MPI has

Table 7. *Correlation between TEI index [pre, after 3 months and difference] and different parameters for group TT (who received fibrinolysis therapy).*

Parameters	Pre-TEI index		After 3 months TEI index		Difference in TEI index	
	Rs-value	P value	Rs-value	P value	Rs-value	P value
Age (years)	−0.067	0.736	−0.075	0.705	−0.083	0.676
BMI [wt/(ht)^2]	−0.114	0.565	0.073	0.713	0.161	0.414
SBP (mmHg)	−0.270	0.165	−0.394*	0.038	−0.453*	0.015
DBP (mmHg)	−0.288	0.137	−0.356	0.063	−0.356	0.063
HR (beat/min)	0.709**	0.000	0.637**	0.000	0.103	0.600
Time to revascularization (hrs.)	0.621**	0.000	0.701**	0.000	−0.120	0.542
EF % by echocardiography	−0.856**	0.000	−0.882**	0.000	0.142	0.471
Mitral closure-opening time by pulsed wave doppler	0.330	0.086	0.420*	0.026	−0.037	0.853
Ejection time pulsed wave doppler	−0.200	0.308	−0.131	0.507	0.177	0.369
Difference EF % by echocardiography	0.268	0.169	0.155	0.431	−0.051	0.795
Difference Mitral closure-opening time by pulsed wave doppler	−0.206	0.293	−0.294	0.128	0.187	0.342
Difference Ejection time pulsed wave doppler	−0.216	0.269	−0.388*	0.041	−0.177	0.369
Ejection fraction % by myocardial perfusion imaging	−0.852**	0.000	−0.882**	0.000	0.139	0.480

Using: Spearman's rank correlation coefficient (rs), P value > 0.05 NS; *P value < 0.05 S; **P value < 0.001 HS.

a positive association with the diastolic dysfunction grade (rho = 0.832, $P < 0.001$) and NYHA grading of dyspnoea (rho = 0.872, $P < 0.001$).[19]

In our study, no significant difference regarding DD, MPI and EF was reported in patients presented with acute STEMI and received any one of reperfusion strategies within the first 3 h according to the method of reperfusion. On the contrary, when the time of revascularization was delayed more than 3 h, a significant difference was found in MPI and EF regarding the method of revascularization where primary PCI was better than thrombolytic therapy. In the WEST study, Armstrong (2006) reported a tendency towards high rates of HF and shock among patients randomized to primary PCI in comparison to pre-hospital fibrinolytic therapy.[20] But lower mortality in patient treated with PPCI. According to the CAPTIM study, Armstrong (2006)[20] demonstrated that patient who received pre-hospital fibrinolytic therapy within two hours after symptom initiation have lower rates of shock and mortality. Eapen et al. (2012) Reported that HF is a time dependent covariate. STEMI patient mortality and post infarction HF rates are expected to continue to decline as primary PCI becomes more widely used and more timely, and evidence-based secondary PCI becomes more widely used.[21] A systemic review published by Goel et al. (2013) included 71 studies stated that longer reperfusion times are related to a greater incidence of HF or LV dysfunction in those undergoing PPCI. In addition, longer time to reperfusion was linked to a greater incidence of systolic HF on admission and follow-up, as well as a worsening of LVEF improvement during follow-up.[22]

Conclusion: MPI measured conventionally and by PW-TD had similar accuracy in diagnosis of post MI HF. There was clinical agreement between MPI and EF in assessment of LV systolic function, while MPI was not reliable for assessment of diastolic function after MI. MPI and EF were a covariate that is affected by time and method of reperfusion, so in case the time of reperfusion was less than three hours there was no difference according to the method of reperfusion but when the time of reperfusion delayed for more than three hours PPCI was much more better in decreasing post MI HF or LV dysfunction than thrombolytic therapy strategy.

5.1. Limitations

Small number of patients enrolled in our study ($n = 60$). It was a single centre study. The lack of long-term follow-up. Our study did not include completely normal healthy subjects. Also, our study did not focus on the cost impact of each reperfusion treatment. The new generation thrombolytics (alteplase, reteplase and tenecteplase) could influence the outcome of the current study.

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Conflict of interest

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