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**ORIGINAL ARTICLE**

# Short-Term Systo-Diastolic Myocardial Recovery Following Primary versus Pharmaco-Invasive Percutaneous Coronary Intervention of Acute Anterior ST Elevation Myocardial Infarction.

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## ABSTRACT

**Background:** Primary percutaneous coronary intervention (PPCI) is the optimal reperfusion method for ST-elevation myocardial infarction (STEMI). When compared to thrombolysis alone, another mechanism of transfer—referred to as pharmaco-invasive PCI—for prompt angioplasty following thrombolytic therapy is necessary.

**Objective:** This study compared primary PCI with pharmacoinvasive PCI for patients admitted with acute anterior STEMI in order to evaluate the short-term recovery of left ventricular systolic and diastolic performance.

**Subjects and methods:** From June 2020 to June 2022, we enrolled 100 patients with anterior STEMI who were admitted to Zagazig University Hospital in Egypt. In two groups of fifty patients each, the patients were assigned. The first group received primary PCI, while the second group underwent pharmacoinvasive PCI within 24 hours after presentation. Three months of follow-up on both groups were used to evaluate the systolic and diastolic myocardial recovery. Ejection fraction (EF) and global longitudinal strain (GLS) were used to evaluate systolic function. Tissue Doppler E/e' ratio was used for assessment of diastolic function. The E/(e'xs') index, a special Doppler measure that considers both systolic and diastolic functions, was also evaluated.

**Results:** In the pharmacoinvasive group, the time from pain to ECG was considerably shorter (p = 0.02). The PPCI group had statistically greater average ST segment elevation and resolution (p= 0.03 and 0.02, respectively). The majority of patients in both groups had MBG 3, and the pharmacoinvasive group had a statistically significantly greater prevalence of establishing MBG 3 (p = 0.02). While there was no statistically significant difference between the two groups for the ejection fraction after revascularization, there was a statistically significant difference between them for the GLS, E/e' ratio, and E/(e'x s') ratio, with P values of 0.02 to 0.003 and 0.004 respectively. The EF and GLS both improved three months after revascularization, and there was a statistically significant difference between the two groups with P values of 0.03 for the GLS, 0.001 for the (E/e'x s' ) ratio, and 0.001 for the E/e' ratio, respectively. The most effective predictors of MACE, according to multivariate regression analysis, were GLS immediately following revascularization and both E/(e'x s') ratio immediately and 3 months after revascularization. E/(e's') at discharge had a cut-off value of 1.72 (78% sensitivity and 70% specificity), which was the best indicator of MACE. The most effective predictors of MACE, according to multivariate regression analysis, were GLS immediately following revascularization and both E/(e'x s') ratio immediately and 3 months after revascularization. E/(e's') at discharge had a cut-off value of 1.72 (78% sensitivity and 70% specificity), which was the best indicator of MACE. **Conclusions:** This study demonstrated that when primary PCI is unavailable or cannot be performed promptly in accordance with the recommendations of the guidelines, pharmaco-invasive PCI within 24 hours of fibrinolysis constitutes a reliable reperfusion approach for patients presenting with anterior STEMI. We also concluded that that pharmaco-invasive strategy could offer a superior outcome regarding microvascular circulation reflected in better myocardial blushing and better short-term recovery of the diastolic function. Evaluation of GLS and E/(e`xs`) ratio before discharge has a prognostic impact regarding short-term systo-diastolic myocardial recovery.

**Keywords:** Primary PCI; Pharmaco-invasive PCI; Systo-diastolic recovery; Anterior STEMI.

## INTRODUCTION

The preferred strategy of treatment for patients with ST-elevation myocardial infarction (STEMI) is primary percutaneous coronary intervention (PPCI). Benefits of PPCI result from the immediate restoration of infarct-related artery

(IRA) blood flow patency **[1]**. An important factor in determining clinical outcomes is the duration from symptoms to myocardial reperfusion **[2]**. Another strategy for treatment of STEMI patients is phramaco-invasive approach which can be defined as a combination of fibrinolytic therapy followed by PCI, either immediately when there is failed fibrinolysis or within 24 hours in case of successful fibrinolysis **[3]**. Infarct related artery patency at initial angiography (defined as TIMI III coronary blood flow grade) has been related to better morbidity and mortality benefits **[4]**. In the event of acute myocardial infarction microvascular blockage may occur due to disintegration of thrombus with subsequent distal embolization. This might occur during performing primary angioplasty due to pushing the thrombus by wires, balloons or stents. Blockage of microcirculation might impair left ventricular functions **[5]**. We hypothesized that using thrombolytic therapy before angioplasty (pharmaco-invasive strategy) might lyse the thrombus and prevent distal embolization. We aimed to compare between primary and pharmaco-invasive PCI regarding the short-term recovery of both systolic and diastolic functions and its reflection on clinical outcomes assessed by major adverse cardiac events (MACE). Acute anterior myocardial infarction outcomes have been shown to be well predicted by the E/(e'xs') index, which combines a parameter that assesses LV systolic (s', systolic mitral annulus velocity) and diastolic performance (E/e', early transmitral/diastolic mitral annulus velocity ratio) **[6]**.

## PATIENTS AND METHODS

In our cross-sectional study, we enrolled one hundred patients were admitted with acute anterior STEMI to Zagazig university hospital, Zagazig, Egypt in the period from June 2020 to June 2022. Each patient gave their informed consent, and the study received the local ethics committee's approval (ZU-IRB#3812). An ECG with ST-segment elevation in two or more contiguous leads with a minimum of 0.1 mV in the frontal leads and 0.2 mV in the precordial leads is required for the diagnosis of acute STEMI **[7]**. Patients with typical chest pain more than 24 hours or with established Q–wave in ECG on presentation, also patients known to have chronic ischemic heart disease, cardiomyopathy, severe valvular dysfunction, any type of congenital heart disease and atrial fibrillation were excluded from the present study.

Patients were divided into two groups. The first group is patients who were transferred directly to the cathlab to undergo primary angioplasty (Primary PCI group). The second group is patients who received thrombolytic therapy and then were routinely transferred to cathlab for mechanical revascularization within 24 hours or immediately if failed thrombolysis when primary PCI could not be done in a timely fashion (Pharmaco-invasive PCI group).

Successful reperfusion was characterised as a reduction in the sum of ST segment elevation in the infarct leads of 50% or greater **[8]**.

All patients were subjected to the following,

**1) History-taking**: demographic data with special emphasis on risk factors of coronary artery disease and time of onset of chest pain.

**2) General and cardiac examination**.

**3) Twelve Lead ECG**: on presentation and at 60 minutes after thrombolysis or immediately after primary PCI. Twenty milliseconds after the J-point, the ST-segment elevation was measured. Infarcted leads had their sum of ST-segment elevations (sum STE) assessed. The percentage of total ST-segment reduction between pre- and post-reperfusion served as an indicator of ST resolution (STR).

**4) Laboratory investigation**: cardiac biomarkers (CK-mb & Troponin I), complete blood count, liver and kidney functions and lipid profile.

**5) Echocardiography**: LV systolic and diastolic functions were evaluated using a General Electric System Vivid-9 machine with a (2.5-5) MHZ probe before, after, and three months thereafter performing PCI. LV systolic function was assessed in both apical two and four chamber views by measuring ejection fraction (EF) with the biplane Simpson's method **[9]**, and calculating global longitudinal strain (GLS) using 2D speckle tracking with QLAB software (Philips CX 50). The trans-mitral Doppler early and late diastolic velocities (E and A waves) were obtained by placing the cursor at the tip of the mitral valve leaflets in the apical four chamber view. The tissue Doppler imaging (TDI) program was set in pulsed-wave Doppler mode. In the apical four-chamber view, a 4–5 mm sample volume was positioned sequentially at the lateral and septal corner of the mitral annulus. Peak e' and s' were recorded for five consecutive cardiac cycles, and the results were averaged. Then, we measured E/e' ratio to assess the LV diastolic function. Also, we measured the unique parameter [E/(e'xs') ratio] which can assess both systolic (by assessing s' velocity) and diastolic functions (by assessing E/e' ratio) **[10]**.

**6) Coronary angiography and emergency PCI:**

PCI of the culprit vessel was performed. Degree of myocardial blush was assessed and defined as follows:

0: absence of myocardial blush.

1: Minimal myocardial contrast density.
2: Moderate myocardial blush but less than that of a non-infarct related coronary artery.
3: Normal myocardial blush similar as that of non-infarct related coronary artery **[11]**.

## STATISTICAL ANALYSIS

Microsoft Excel was used to gather, enter, and analyse data. The Statistical Package for the Social Sciences (SPSS) version 20 software was then used to import the data for analysis. The following tests were performed to determine whether variations in representations of qualitative and quantitative data were statistically significant: To evaluate the significance of the difference between the two quantitative groups, an independent (T) test was performed. Fisher Exact and the Chi Square Test were employed to examine the comparison and relationship between two qualitative variables. Using a Receiver Operating Characteristic (ROC) curve for E/(e'xs') ratio, cardiac events in patients with anterior ST-segment elevation myocardial infarction were predicted. employing univariate and multivariate analyses to clarify independent factors of major adverse cardiac events (MACE). A P-value of 0.05 or less was considered statistically significant for two-tailed tests, while 0.001 was considered extremely significant.

## RESULTS

There was no statistically significant differences between both groups regarding demographic factors as shown in Table (1). Table (2) shows that there was a statistically significant difference between both groups regarding pain to ECG time with a P value of 0.02. That time was significantly shorter in the pharmaco-invasive group with a mean of 106.4 ± 39.81 minutes compared to the PPCI group which was 135.6 ± 45.4 minutes. The table shows also that the mean door to balloon time was 70 ± 15 minutes while the mean door to needle time was only 25 ± 4 minutes. The mean door to PCI in the pharmaco-invasive group was 20 ± 2 hours. Systolic blood pressure was significantly higher in primary PCI group (p: 0.04), but no difference between both groups regarding heart rate. Sum of ST segment elevation and resolution were statistically higher in the PPCI group (p= 0.03 and 0.02 respectively). Table (3) shows that the mean serum creatinine level was slightly higher on the PPCI arm with a negligible statistical variation. The mean LDL was higher on the pharmaco-invasive arm with a non-significant statistical variation between the two groups. The mean serum high-sensitive troponin was almost equal between the two arms of the study with also non-significant difference. For the rest of the lab results, there was no statistically significant difference between the two groups. PCI to the culprit vessel was performed. LAD was the culprit vessel in all patients. Only 2 patients in both groups had MBG 1. The majority of patients had MBG 3 with statistically significantly higher prevalence among the pharmaco-invasive group with p value 0.02 (Table 4). On admission, there was no statistically significant difference between the two groups for any of the echocardiographic data, including ejection fraction, global longitudinal strain, E/e' and E/(e'xs'), as indicated in Table (5). All metrics showed a slight improvement after revascularization. The ejection fraction did not significantly differ between the two groups, however there was a statistically significant difference in GLS and E/e' with P values of 0.02 and 0.003, respectively. Three months after revascularization there was also improvement in the EF and GLS with statistically significant difference between the two groups regarding only the GLS (p: 0.03). There was a highly statistically significant difference between the two groups regarding E/e` with a P value of <0.001. Baseline E/(e`xs`) ratio was similar between both groups on admission (p: 0.09). After revascularization, the ratio improved in both groups but was statistically better in the pharmaco-invasive arm (p: 0.004) which continued even on the 3-month follow-up (p: <0.001). Regarding the study's major adverse cardiac events (MACE), this is shown in Table (6). With a P value of (0.04 and 0.02, respectively) in favor of the pharmaco-invasive arm, there were statistically significant differences between the two groups regarding heart failure and malignant arrhythmia but not regarding mortality or recurrent MI. Multivariate regression analysis showed that GLS immediately after revascularization and both E/(e`x s`) ratio immediately and 3 months after revascularization were the most powerful predictors for MACE (Table 7). With AUC = 0.769, 95%CI = 0.682-0.855, p=0.001; the best cut-off value for E/(e's') at discharge to predict MACE was 1.72 (78% sensitivity and 70% specificity), (Table 8, Figure 1).

**Table (1):** Demographic characteristics of the studied groups

| Demographic characteristics | Primary PCI (n=50) | Pharmaco-invasive PCI (n=50) | P-value |
|---|---|---|---|
| **Age (years)** | 53.44 ± 8.94 | 50.46 ± 7.29 | 0.08 |
| **Male sex, n(%)** | 25 (50%) | 30 (60%) | 0.39 |
| **Diabetes Mellitus** | 26 (52%) | 24(48%) | 0.1 |
| **Hypertension** | 24 (68%) | 20 (48%) | 0.39 |
| **+Ve Family History** | 26 (52%) | 24 (48%) | 0.25 |
| **Smoking** | 26 (54%) | 22 (48%) | 0.27 |
| **Dyslipidemia** | 32 (64%) | 28 (56%) | 0.42 |

PCI: percutaneous coronary intervention.
* Statistically significant difference between two groups ($p < 0.05$)
**Highly statistically significant difference between two groups ($p<0.001$)

**Table (2):** Clinical characteristics of the studied groups

| | Primary PCI (n=50) | Pharmaco-invasive PCI (n=50) | P-value |
|---|---|---|---|
| **Pain to ECG (minutes)** | 135.6 ± 45.4 | 106.4 ± 39.81 | 0.02* |
| **Door to balloon (minutes)** | 70 ± 15 | | - |
| **Door to Needle(thrombolysis) (minutes)** | - | 25 ± 4 | - |
| **Door to PCI(pharmaco-invasive group)(hours)** | | 20 ± 2 | |
| **SBP(mmHg)** | 140.5 ±20 | 130 ± 15 | 0.04* |
| **HR (bpm)** | 81± 15 | 80 ± 19 | 0.5 |
| **Sum STE, mm** | 13.8 ± 3.1 | 10 ± 1.2 | 0.03* |
| **Sum STR, %** | 75 ± 6.2 | 68.2 ± 6.9 | 0.02* |

ECG: electrocardiogram; HR: heart rate; PCI: percutaneous coronary intervention. SPB: Systolic blood pressure; STE: ST segment elevation; STR: ST segment resolution
* Statistically significant difference between two groups ($p < 0.05$)
**Highly statistically significant difference between two groups ($p<0.001$)

**Table (3):** Laboratory findings of the studied groups

| Laboratory characteristics | Primary PCI (n=50) | Pharmaco-invasive (n=50) | P-value |
|---|---|---|---|
| **Haemoglobin (gm/dl)** | 10.32 ± 2.22 | 10.83 ± 2.18 | 0.42 |
| **TLC (mg/dl)** | 8.26 ± 2.59 | 8.18 ± 1.86 | 0.9 |
| **Platelet count (x103/µL)** | 339.4 ± 50.25 | 318.68 ± 74.87 | 0.26 |
| **Creatinine (mg/dl)** | 1.36 ± 0.53 | 1.10 ± 0.48 | 0.08 |
| **LDL-C (mg/dl)** | 152.16 ± 23.06 | 155.20 ± 24.83 | 0.66 |
| **CK-MB (U/L)** | 125.84 ± 93.85 | 141.60 ± 78.05 | 0.52 |
| **High-sensitive Troponin** | 5891.11 ± 2842.41 | 6717.62 ± 2889.75 | 0.66 |

LDL-C: low density lipoprotein cholesterol; PCI: percutaneous coronary intervention; TLC: total leucocytic count.
* Statistically significant difference between two groups ($p < 0.05$)
**Highly statistically significant difference between two groups ($p<0.001$)

**Table (4):** Comparison of myocardial blush grade between the studied groups

| MBG (Post -PCI) | Primary PCI(n=50) | Pharmaco-invasive(n=50) | P-value |
|---|---|---|---|
| **1** | 2 (4%) | 2 (4%) | 0.02* |
| **2** | 18 (36%) | 8 (16%) | |
| **3** | 30 (60%) | 40 (80%) | |

MBG: myocardial blush grade; PCI: percutaneous coronary intervention.
* Statistically significant difference between two groups ($p < 0.05$)
**Highly statistically significant difference between two groups ($p<0.001$)

**Table (5):** Echocardiographic characteristics of the studied groups

| Echocardiographic characteristics | Primary PCI (n=50) | Pharmaco-invasive (n=50) | P-value |
|---|---|---|---|
| **Before revascularization** | | | |
| EF (%) | 40 ± 4.8 | 41 ± 6.7 | 0.7 |
| GLS (%) | -12.6 ± 2.1 | -12.4 ± 1.9 | 0.6 |
| E/e` | 18.2 ± 3.6 | 17.9 ± 3.9 | 0.8 |
| E/(e`xs`) | 2.1 ± 1.2 | 2 ± 1.1 | 0.09 |
| **After revascularization** | | | |
| EF (%) | 46 ± 5.3 | 45 ± 4.9 | 0.2 |
| GLS (%) | -13.9 ± 5.8 | -15.2 ± 2.6 | 0.02* |
| E/e` | 17.6 ± 3.1 | 14 ± 2.7 | 0.003* |
| E/(e`xs`) | 1.91 ± 1.12 | 1.61 ± 1.2 | 0.004* |
| **Three months after revascularization** | | | |
| EF (%) | 47.8 ± 3.4 | 49.2 ± 2.9 | 0.6 |
| GLS (%) | -15± 2.9 | -16.5 ± 1.6 | 0.03* |
| E/e` | 16.9 ± 2.9 | 10.5 ± 3.1 | < 0.001** |
| E/(e`xs`) | 1.8 ± 1.2 | 1.5 ± 1.1 | <0.001** |

EF: ejection fraction; GLS: global longitudinal strain; PCI: percutaneous coronary intervention.
* Statistically significant difference between two groups ($p < 0.05$)
**Highly statistically significant difference between two groups ($p<0.001$)

**Table (6):** Three-month major adverse cardiac events (MACE) of the studied groups

| | Primary PCI (n=50) | Pharmaco-invasive (n=50) | P-value |
|---|---|---|---|
| **Mortality** | 4 (8%) | 5 (10%) | 0.73 |
| **Heart failure** | 13 (26%) | 5 (10%) | 0.04* |
| **Recurrent MI** | 6 (12%) | 4 (8%) | 0.51 |
| **Malignant arrhythmia** | 14 (28%) | 5 (10%) | 0.02* |

MACE: major adverse cardiac events; MI: myocardial infarction; PCI: percutaneous coronary intervention.
* Statistically significant difference between two groups ($p < 0.05$)
**Highly statistically significant difference between two groups ($p<0.001$)

**Table (7):** Univariate and multivariate regression analysis for prediction of MACE.

| | Univariate analysis | | Multivariate analysis | |
|---|---|---|---|---|
| | P-value | OR (95% C.I) | P-value | OR (95% C.I) |
| Diabetes Mellitus | <0.001** | 1.072 (1.050 – 1.093) | 0.06 | 0.460 (0.205 – 1.030) |
| Pain to ECG (minutes) | 0.03* | 2.751 (1.813 – 4.175) | 0.16 | 0.335 (0.073 – 1.543) |
| EF, % | 0.03* | 2.954 (1.946 – 4.484) | 0.12 | 3.412 (0.739 – 15.756) |
| GLS, %, after revascularization | 0.003* | 1.759 (1.496 – 2.067) | 0.002* | 0.845 (0.245 – 2.908) |

| | Univariate analysis | | Multivariate analysis | |
|---|---|---|---|---|
| | P-value | OR (95% C.I) | P-value | OR (95% C.I) |
| Sum STE resolution, % | 0.03* | 1.129 (1.085 – 1.174) | 0.25 | 0.998 (0.994 – 1.002) |
| E/(e`x s`), after revascularization | 0.004* | 3.073 (1.944 – 4.859) | 0.001* | 2.113 (1.241 - 2.28) |
| E/(e`x s`), three months after revascularization | <0.001** | 1.002 (1.001 – 1.004) | 0.002* | 6.539 (1.977- 21.626) |

MACE: major adverse cardiac events; C.I: confidence interval; ECG: electrocardiogram; OR: odds ratio; SBP: systolic blood pressure; STE: ST segment elevation.
* Statistically significant difference between two groups ($p < 0.05$)
**Highly statistically significant difference between two groups ($p<0.001$)

**Table (8):** Main findings of the Receiver operating characteristic (ROC) curve for E/(e`×s`) to

| AUC | Cut-off value | Sensitivity | Specificity | 95%CI | Accuracy |
|---|---|---|---|---|---|
| 0.769 | 1.72 | 78% | 70% | 0.682–0.855 | 88% |

AUC = area under the ROC curve; CI = confidence interval

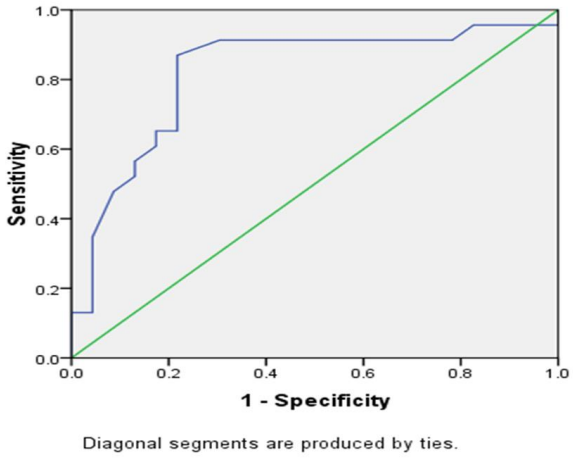


**Figure (1)** Receiver operating characteristic (ROC) curve for E/(e`×s`) to predict cardiac events in patients with anterior ST-segment elevation myocardial infarction..

## DISCUSSION

The present study showed non-significant male predominance of coronary artery disease which agrees with **[12]**. However, other research indicates that the lifetime CVD risk is comparable for both men and women **[13]**. Regarding the major cardiovascular risk factors, they were equally distributed among the two groups. The clinical examination in our study did not reveal any statistically significant differences between the two groups, with the exception of systolic blood pressure, which was statistically significantly higher in the primary PCI group. A typical modifiable risk factor for IHD is systolic blood pressure **[14]**. Our study found that, with mean times of 25±4 and 70±15 minutes, respectively, the door to needle time was much shorter than the door to balloon duration. These results are consistent with the 2017 ESC STEMI guidelines, which state that it should take fewer than 90 and 30 minutes, respectively, to get from the door to the balloon and the door to the needle **[1]**. Also, this agreed with **Zubaid et al. [15]** who found that the median door to needle time (45 minutes) was shorter than the median door to balloon time (75 minutes) in a study comparing primary and pharmaco-invasive PCI in the Middle East. The mean door to pharmaco-invasive PCI was 20 ± 2 hours which agrees with the ESC 2017 STEMI guidelines which recommended that PCI should be done routinely within 24 hours post successful fibrinolysis **[1]**. On the contrary, Alex et al. reported a significantly shorter mean time of only 10 hours between fibrinolysis and PCI **[16]**. This finding shows that we should improve our logistics at our center and aim to move the lysed patients to the cathlab as soon as possible. The fact that some patients sought medical attention in another facility and arrived at our center with an ECG diagnosis could be the reason why the mean pain to ECG time was shorter in the pharmaco-invasive group. In our study, we found that the primary PCI arm had greater ST segment resolution. This is at odds with **Bainey et al. [17]** who stated that pharmaco-invasive

approach was linked to enhanced cumulative ST-segment resolution of 50% or more. This might be because he evaluated ST segment resolution after PCI while we did so after the initial reperfusion method (thrombolytic treatment). One of the independent predictors of better outcomes in ST-elevation myocardial infarction is a high myocardial blush grade **[18]**. In accordance with **Shaheen et al. [19]**, we noticed better myocardial perfusion in favor of pharmaco-invasive group as assessed by myocardial perfusion grade (MBG). Most patients on both arms had MBG 3, but the pharmaco-invasive arm had a larger proportion of patients with MBG 3 (P value 0.02). Left ventricular GLS has been shown to be a highly accurate predictor of unfavorable LV remodeling and cardiac events in people with acute myocardial infarction. GLS has an advantage over LVEF in that there is less inter-observer variability **[20]**. The left atrium and left ventricle's end pressures serve as the foundation for the E/e' ratio, a metric of diastolic function **[21]**. The baseline echocardiographic measures analysed in our investigation did not reveal any statistically significant differences between the two groups. Following PCI, both groups' readings for EF and GLS have improved. The pharmaco-invasive arm had a little better improvement, but there were no statistically significant differences between the two groups. This contrasts with the findings of **Ammar et al. [22]** who found that STEMI patients who underwent revascularization by the two methods (primary and pharmaco-invasive PCI) upon discharge experienced an increase in the EF, with a statistically significant difference favoring the primary PCI group. After three months, follow up showed there was a better improvement in both arms regarding the ejection fraction but there was no statistically significant difference (p value: 0.6). **Garaygordobil et al. [23]** reported that patients who underwent the pharmaco-invasive approach had an EF that significantly improved after six months, going from a mean EF of 48.08± 6.23 at baseline to 53.12± 5.61 at that point. The follow-up EF at 6 months was nearly identical between the PPCI group and the pharmaco-invasive patients who underwent early revascularization (3–10 hours following chest discomfort), according to **Aboleineen et al. [24]**. In our study we have noticed that the GLS improved in both arms of the study at three months' follow up with statistically significant difference favoring primary PCI. This is consistent with Ravindra et al.'s research **[25]**, which found that GLS was better in patients who underwent primary PCI than in those who underwent pharmaco-invasive strategy, with a statistically significant difference of (P value 0.03). There was improvement in the diastolic function as assessed by E/e` immediately post PCI on both arms with a statistically significant difference in favor of the pharmaco-invasive arm with P value of 0.003. This favor continued consistently up to three-month follow-up with a P value of <0.001. After three months, the final mean value of E/e` was 10.5 ± 3.1 in the pharmaco-invasive group which corresponds to the normal values while in the primary PCI group was 16.9 ± 2.9 which supports our study hypothesis that pharmaco-invasive strategy has better outcome regarding shore-term diastolic function. **Ammar et al. [22]** found nearly equal improvement of diastolic function at discharge and after six months between both groups. This may be attributed to usage of a different parameter (mitral inflow pattern assessed by pulsed Doppler). **Bayat et al. [26]** reported that E/e` improves after revascularization with PCI in patients with coronary artery disease. Systolic mitral annulus velocity (s') and/or early diastolic mitral annulus velocity (e') have both significantly decreased in patients with ischemic heart disease **[27]**. (E/e`) ratio can predict LV remodeling following MI. It is possible to measure the entity of regional motion dysfunction using the s' wave. The sub-endocardial longitudinally orientated myocardial fibers, which are thought to be the most susceptible to ischemia, are related with this velocity **[28]**. Andrea et al. assert that s' velocity may be a more reliable predictor of outcome than LV ejection fraction (LVEF) **[29]** because it may signal latent LV systolic dysfunction. Collecting both diastolic and systolic indices in one parameter as [E/ (e×'s')] may be easily applicable. In the present study, we found steady progressive improvement of the [E/ (e×'s')] ratio in favor of the pharmaco-invasive group. Independent of LVEF, a [E/ (e's')] ratio >2.34 indicates positive remodeling after initial STEMI managed with PPCI according to **Tiryakioglu et al. [30]**. The septal [E/ (e's')] values assessed can significantly predict LV remodeling in the 6-month follow-up, they have concluded. Independent of LVEF, a [E/ (e's')] ratio >2.34 indicates positive remodelling. According to **Mornos et al. [31]**, the [E/(e's')] ratio is a reliable independent predictor of cardiovascular mortality in individuals with heart failure. Our investigation revealed a statistically significant difference in the incidence of malignant arrhythmias and heart failure between the two groups in MACE, with p values of 0.04 and 0.02 favoring pharmaco-invasive PCI, respectively. This is in contrast to **Zubaid et al. [15]**, who claimed no differences in death, re-infarction, stroke, or congestive heart

failure between both groups on 6-month follow-up (p=0.79). Also, according to on the other hand, **Kawecki et al. [32]** found that compared to the primary PCI group, pharmaco-invasive patients had increased 6- and 12-month mortality after 30 days (P<0.001). This can be attributable to the sizable patient population (132,715 patients) included in their study. By using univariate and multivariate analysis in our study, we have found that that GLS immediately after revascularization and E/(e`xs`) ratio both immediately and 3 months after revascularization were the most powerful independent predictors for MACE. This agrees with what **McEntegart et al. [33]** who reported that impaired systolic and diastolic functional recovery was found to be an independent predictor of MACE.

## CONCLUSIONS

This study showed that pharmaco-invasive PCI within 24 hours is non-inferior for patients presenting with anterior ST elevation myocardial infarction, when primary PCI isn't available or cannot be done in a timely fashion according to the guidelines' recommendations. We also concluded that that pharmaco-invasive strategy could offer a superior outcome regarding microvascular circulation reflected in better myocardial blushing and better short-term recovery of the diastolic function. Procedure problems, such as the distal embolisation of microemboli, may be to blame for the persistent diastolic deterioration in the primary PCI group. Evaluation of GLS and E/(e`xs`) before discharge has a prognostic impact regarding short-term systo-diastolic myocardial recovery.

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