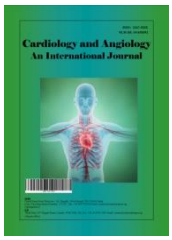

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# Predictive Value of TIMI Risk Index for Angiographic No-reflow after Primary Percutaneous Coronary Intervention

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

**Objective:** In patients with acute coronary artery disease, the TIMI risk index (TRI), the thrombolysis in myocardial infarction (TIMI) risk score, and the global registry of acute coronary events (GRACE) risk score (GRS) have all been documented. The aim of this study was to determine the relationship between no-reflow (NRF) and admission TRI, major cardiac events (MACE), and in-hospital mortality in patients undergoing primary percutaneous coronary intervention (P-PCI).
**Methods:** Between March and December 2019, 100 consecutive patients diagnosed with STEMI and treated with PPCI at Tanta Main University Hospital in Tanta, Egypt, were included in the research population. Each patient consented following a thorough history taking, evaluation of coronary risk factors, clinical examination, and electrocardiogram analysis. Additionally, all instances were classified using the Killip method. The GRS, TRS, and TRI values were examined.
**Results:** The GRS, TRS, and TRI scores were significantly associated with increased NRF, MACE, and hospital mortality in STEMI patients treated with P-PCI, suggesting that TRI is a straightforward indicator with fewer parameters that accurately reflects P-PCI success.
**Conclusion:** TRI has been demonstrated to enhance the risk of in-hospital mortality and MACE. TRI uses straightforward and cost-effective ways to test patients who have experienced a STEMI. Additionally, a high TRI may assist in identifying high-risk individuals and developing suitable treatment solutions.

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*Keywords: TIMI Risk Index (TRI); Acute myocardial infarction; Percutaneous coronary intervention (PCI), No-reflow (NRF); Global Registry of Acute Coronary Events (GRACE); risk score (GRS).*

## 1. INTRODUCTION

Rapid restoration of the damaged myocardium is crucial for effective therapy following AMI. It has been demonstrated that TRI increases the risk of in-hospital mortality and serious adverse cardiac events (MACE). TRI evaluates STEMI survivors in a straightforward and cost-effective method. Additionally, a high TRI may help in the identification of those at risk and the development of suitable treatment alternatives [1].

Three interdependent factors best explain the success of a PCI operation: procedural events, angiographic findings, and clinical outcomes.

The ACCF/AHA/SCAI defined angiographic success in 2011 as a diameter stenosis of less than 10%. (With a final aim of 0%) with a final TIMI flow grade of 3, without distal embolization obstruction, angiographic thrombus, a significant side branch, or flow-limiting dissection, was defined as angiographic success without significant in-hospital clinical complications (e.g., stroke, emergency CABG, mortality, MI), whereas clinical success requires both procedural and anatomic success, as well as relief of signs and symptoms [2].

Despite stent implantation to restore patency to an infarcted artery, marked reperfusion of the myocardium was not found in 2.3 %: 29 % of cases with AMI, a phenomenon defined as the no-reflow (NRF) phenomenon [3].

Diabetes, congestive heart failure, chronic kidney disease (CKD), multivessel CAD, and advanced age are all risk factors for increased rates of primary PCI complication. In clinical practice, a large number of laboratory parameters and scoring systems have been used to assess PCI associated mortality. However, cardiovascular medicine professionals still require a cost-effective, easily accessible, and noninvasive predictor of P-PCI success. Numerous risk scoring and classification systems are regularly used to evaluate STEMI cases of high risk. In hundreds of thousands of patients, the in-hospital death global registry of acute coronary events (GRACE) risk score (GRS) and the thrombolysis in myocardial infarction (TIMI) risk score (TRS) have been shown to reliably predict early and late deaths [4].

Recently, it was discovered that the TIMI risk index (TRI), which is used to measure mortality, may be easier to analyze and score in STEMI survivors due to the absence of certain criteria.

## 2. PATIENTS AND METHODS

This was a prospective study conducted between March and December 2019 on 100 STEMI patients treated at Tanta Main University Hospital. The project enrolled STEMI patients who had percutaneous coronary intervention (PCI) in accordance with European Society of Cardiology (ESC) guidelines. Patients who had thrombolytic therapy, those who did not undergo PPCI, those who presented more than twelve hours after the beginning of symptoms, and those with chronic renal failure on dialysis or medication were excluded from the study.

Each patient's file contained the following: Patients provide informed consent. Consent is obtained from guardians in the case of incompetent patients; a thorough history is gathered with a specific focus on: Family history, gender, age, smoking, dyslipidemia, hypertension (HTN), diabetes and are all risk factors. Acute coronary syndrome and revascularization history; comprehensive clinical examination, including evidence of pulse, blood pressure on arrival, and killip class. At admission, the CKMB and creatinine levels are determined.

We performed a 12-lead electrocardiogram (ECG) and two-dimensional transthoracic echocardiography upon admission to CCU. Traditionally, coronary angiography has been used to determine the early TIMI flow of the infarcted associated artery (IRA). TRS was assessed in all patients regardless of age, weight, hypertension, diabetes mellitus (DM), angina, heart rate greater than 100 beats per minute (bpm), systolic blood pressure (SBP) greater than 100 mmHg, Killip class II-IV, anterior MI, or LBBB presentation, as well as latency greater than 4 hours [5].

Evaluation of GRS for all cases including age, SBP, on admission cardiac arrest, heart rate,

Killip class, creatinine, elevated cardiac markers, and ST-segment deviation were evaluated [6].

The following formula was used for calculation of TRI of all patients:

{Heart rate × (age÷10)$^2$} / SBP [7].

Patients were observed for MACE throughout the period of in-hospital follow-up.

## 2.1 Statistical Analysis

The data were analyzed using the Statistical Program for Social Science (SPSS) version 23 and MedCalc version 15.4. Percentages and frequencies were used to convey qualitative data. The standard deviation of a set of quantitative data is expressed by the term mean std dev (SD).

The following tests conducted:

- when comparing between two means, independent-samples t-test of significance was used
- For comparison of two means of not normally distributed data. Mann Whitney U test was performed.
- In order to compare proportions between two qualitative parameters, Chi-square ($X^2$) test of significance was performed.
- Fisher Exact test is a type of test of significance that is employed in 2 by 2 tables instead of the chi square test, particularly in case of small sample size.

Non - parametric tests are used if the data were abnormally distributed, while in normally distributed data, independent t-test was used for comparison between two independent populations. The Mann Whitney test was used to evaluate data with an unusual distribution. The results of the significance test are given as a two-tailed probability. At a 5% level of significance, the gathered findings were deemed to be significant.

## 3. RESULTS

The trial was a one-center, observational, prospective trial included 100 successive cases admitted to Tanta University Hospital for P-PCI from March 2019 to December 2019. The cases classified into two groups depending on the final TIMI flow after the primary PCI as follows:

- **The re-reflow group (Group A):**

This group consisted of 81 cases, 47 were female (58%) and 34 were male (42%).

- **The NRF group (Group B):**

This group consisted of 19 cases; 8 were female (42.1%). While 11 were male (57.9%).

After that, the two groups were compared depending on laboratory and clinical factors (gender, age, angina, lack of pre-infarction), as well as on admission cardiac risk scores.

## 3.1 Baseline Clinical Characteristics: Table (1, 2)

- **Age:** With a statistically significant p value (<0.05*), NRF patients were older than reflow patients; the mean age was 52.44 ± 10.792 years for group A while 60.66 ± 12.77 years for group B.
- **Sex:** There were no significant differences in gender between the two groups; in group A 47 (85%) were female, and 34 (42%) were male, whereas in group B 8 (57.9%) were female, and 11 (57.9%) were male.
- **Diabetes Mellitus:** When the P value was more than 0.05, there was no statistically significant difference between the two groups. 42 (51.9%) of individuals in group A have diabetes, compared to 9 (47.4%) of those in group B.
- **Hypertension:** There was no statistically significant difference between the two groups when the P value was larger than 0.05. HTN was discovered in 37 (45.7%) of individuals in group A and 6 (31.6%) of participants in group B.
- **Dyslipidemia:** When the P value was greater than 0.05, there was no statistically significant difference between the two groups. Dyslipidemia is seen in 36 (44.4%) of group A patients and 11 (57.9%) of group B patients.
- **Smoking:** There was no statistically significant difference between the two groups when the P value was larger than 0.05. In group A, 34 (42.0 percent) of patients were smokers. Ten patients (52.6 percent) in group B are smokers.
- **History of IHD:** There was no statistically significant difference between the two groups when the P value was larger than

0.05. In group A, 17 (21.0%) cases had a history of IHD, whereas in group B, 5 (26.3%) cases had a history of IHD.

- **Family history of IHD:** When the P value was greater than 0.05, there was no statistically significant difference between the two groups. In 34 (42.0 %) of group A patients and 11 (57.9 %) of group B patients.
- **Previous PCI:** There was no statistically significant difference between the two groups with a P value greater than 0.05. In 29 (35.8 %) of group A patients and 9 (47.4 %) of group B patients.

## 3.2 Admission Characteristics: (Table 3,4)

### 3.2.1 The admission systolic blood pressure (SBP)

Between the two groups, there was statistically significant difference. concerning the systolic BP and pulse rate with the P value < 0.05. In group A was 110.8±18.7 mmHg, and in group B was 95.9± 11.4 mmHg. The average mean pulse rate was 88.8 ± 17.5 bpm for group A, and 96±17.8 bpm in group B.

**Killip class:**

With a P value of 0.05*, there was a statistically significant difference between the two groups. The number of patients classified as Killip I or II was 69 (85.1%) in group A and 8 (40%) in group B. In group A, there were 12 (14.9 %) patients with Killip III class and 11 (60 %) patients with Killip VI class.

**ECG diagnosis:**

Concerning ECG diagnosis; With a P value > 0.05*, there was no statistically significant difference between the two groups. In group A, 43 (53.1%) patients presented with anterior STEMI, whereas 7 (36.8%) patients presented with posterior STEMI. In group A, 38 (46.9 %) patients presented with non-anterior MI, whereas 12 (63.2 %) patients presented with anterior MI.

**Table 1. Demographic data in both studied groups.**

| | Group A (n = 81) | | Group B (n = 19) | | p |
|---|---|---|---|---|---|
| | No | % | No | % | |
| **Sex** | | | | | |
| Male | 34 | 42 | 11 | 59.7 | 0.306 |
| Female | 47 | 58 | 8 | 42.1 | |
| **Age** | | | | | |
| Min. – Max. | 29.0 – 81.0 | | 44.0 – 78.0 | | |
| Mean ± SD | 52.44 ± 10.792 | | 60.66± 12.77 | | <0.014* |
| Median | 58.0 | | 62.0 | | |

**: significant as p value ≤ .05.*

**Table 2. Diabetes, hypertension, smoking, and other risk factors in the studied groups.**

| | Group A (n = 81) | | Group B (n = 19) | | P |
|---|---|---|---|---|---|
| | No | % | No | % | |
| **Diabetes** | 39 | 48.2 | 10 | 52.7 | |
| Non-diabetic Diabetic | 42 | 51.8 | 9 | 47.3 | 0.802 |
| **Hypertension** | 37 | 45.7 | 6 | 31.6 | 0.311 |
| **Smoking** | | | | | |
| Non-smoker | 48 | 59.2 | 9 | 47.4 | 0.448 |
| Smoker | 34 | 40.8 | 10 | 52.6 | |
| **Dyslipidemia** | 36 | 44.4 | 11 | 57.9 | 0.318 |
| **Family History** | 34 | 42.0 | 11 | 57.9 | 0.306 |
| **Previous IHD** | 7 | 8.5 | 1 | 5.6 | 0.762 |
| **previous PCI** | 29 | 35.8 | 9 | 47.4 | 0.433 |

**Table 3. SBP, pulse, and killip class in both studied groups**

| | Group A (n = 81) | | Group B (n = 19) | | P |
|---|---|---|---|---|---|
| **SBP** | | | | | |
| Min. – Max. | 80.0 – 190 | | 80.0–140.0 | | |
| Mean ± SD | 110.8± 18.7 | | 95.5± 11.4 | | 0.001* |
| **Pulse** | | | | | |
| Min. – Max. | 45.0 – 130.0 | | 44.0 – 1200.0 | | |
| Mean ± SD | 88.8 ±17.5 | | 96± 17.8 | | <0.001* |
| | **Group A (n = 82)** | | **Group B (n = 18)** | | **P** |
| | **No** | **%** | **No** | **%** | |
| **Killip class** | | | | | |
| Killip class I & II | 69 | 85.1 | 8 | 40 | <0.001* |
| Killip class III & IV | 12 | 14.9 | 11 | 60 | |

**: Statistically significant at p ≤ 0.05.*

**Table 4. ECG findings in both studied groups**

| | Group A (n = 81) | | Group B (n = 19) | | P |
|---|---|---|---|---|---|
| | **No** | **%** | **No** | **%** | |
| **ECG** | | | | | |
| Anterior MI | 43 | 53.1 | 7 | 36.8 | 0.308 |
| Non anterior MI | 38 | 46.9 | 12 | 63.2 | |

**Table 5. Duration of chest pain in both studied groups**

| | Group A (n = 81) | Group B (n = 19) | P |
|---|---|---|---|
| **Duration of chest pain (h)** | | | |
| Min. – Max. | 1-7 | 3- 9 | |
| Mean ± SD | 4.09 ± 2.152 | 5.89 ± 1.997 | 0.001* |

**: Significant as p ≤ 0.05*

**Table 6. Cardiac risk scores on admission in both studied groups**

| | Group A (n = 81) | Group B (n = 19) | P |
|---|---|---|---|
| TIMI risk score | | | |
| Mean ± SD | 3.75±1.774 | 4.65±2.957 | 0.039* |
| **GRACE score** | | | |
| Mean ± SD | 154.48±35.223 | 177.68±54.812 | 0.0012* |
| **TIMI risk index** | | | |
| Mean ± SD | 25.575±11.681 | 33.255±15.163 | <0.026* |

*: Significant as p ≤ 0.05

**Duration of chest pain:**

There was statistically significant difference between the two groups with the P value <0.05*. The mean time from onset of symptoms to presentation was 4.09±2.15 hours in group A, versus 5.89±199 hours in group B.

## 3.3 Cardiac Risk Scores on Admission: Table (6)

With a P value of <0.05, there was a statistically significant difference between the two groups. The mean results of TIMI risk score, GRACE score, and TIMI risk index are higher in group B (4.65±2.957, 177.68±54.812, 33.255±15.163) than in group A (3.75±1.774, 154.48±35.223, 25.575±11.681).

## 3.4 Echocardiographic Parameters

With a P value of <0.05, there was a statistically significant difference between the two groups The mean results of EF that was lower in group B (NRF) than group A (reflow) (42.8±6.3 % VS.

52.3±6.2 %), while LVESV was higher in group B than group A (67.4±8.3 ml VS. 63.9±8.9 ml), also LVEDV was higher in group B than group A (195.4±16.3 ml VS. 165.4±15.6 ml).

## 3.5 Initial Laboratory Results

### 3.5.1 Cardiac enzymes

With a P value of >0.05, there was no statistically significant difference between the two groups. In group A the mean CKMB value was 51.40±19.589mg/dl. While in group B it was 54.26±21.574.

### 3.5.2 Serum creatinine

With a P value of >0.05, there was no statistically significant difference between the two groups. In group A the mean creatinine value was 1.198±0.335mg/dl, while in group B it was 1.205±0.376.

### 3.5.3 Angiographic findings and procedural aspects: Number of vessels:

With a P value of >0.05, there was no statistically significant difference between the two groups. In group A 32(39.5%) patients had one vessel disease and 49(60.5%) had more than one vessel, while in group B 11(57.9%) patients had one vessel disease and 8(42.1%) had more than one vessel occlusion.

## 3.6 Culprit Artery

With a P value of >0.05, there was no statistically significant difference between the two groups. In group A, culprit artery was RCA in 24(29.3%) patients, LCX in 8(11%) patients and LAD in 49 (59.7%) patients. In group B, culprit artery was RCA in 7 (38.8%) patients LCX in 2(5.6%) patients and LAD in 10(55.6%) Patients.

**Table 7. Echocardiographic parameters in both studied groups**

| | Group A (n = 89) | Group B (n = 21) | p |
|---|---|---|---|
| **Ejection fraction EF %** | | | <0.001* |
| Mean ± SD | 52.3±6.2 | 42.8±6.3 | |
| **LVEDV** | | | <0.001* |
| Mean ± SD | 165.4±15.6 | 195.4±16.3 | |
| **LVESV** | | | <0.01* |
| Mean ± SD | 63.9±8.9 | 67.4±8.3 | |
| **LA diameter** | | | 0.404 |
| Mean ± SD | 4.920±0.383 | 5.00±0.340 | |

**Table 8. CKMB level in both studied groups**

| | Group A (n = 81) | | Group B (n = 19) | | P value |
|---|---|---|---|---|---|
| | **Mean** | SD | **Mean** | SD | |
| CKMB | **51.40** | 19.589 | **54.26** | 21.574 | 0.574 |

**Table 9. Serum creatinine level in both studied groups**

| | Group A (n = 81) | | Group B (n = 19) | | P value |
|---|---|---|---|---|---|
| | **Mean** | SD | **Mean** | SD | |
| Creatinine | **1.198** | 0.335 | **1.205** | 0.376 | 0.930 |

**Table 10. Number of vessels**

| | Group A (n = 81) | | Group B (n = 19) | | P |
|---|---|---|---|---|---|
| | **No** | **%** | **No** | **%** | |
| **Number of vessels** | | | | | |
| One vessel | 32 | 39.5 | 11 | 57.9 | 0.198 |
| More than one | 49 | 60.5 | 8 | 42.1 | |

**Table 11. Patient's culprit artery in both groups**

| | Group A (n = 81) | | Group B (n = 19) | | P |
|---|---|---|---|---|---|
| | No | % | No | % | |
| **Culprit Artery** | | | | | |
| LAD | 49 | 59.7 | 10 | 55.6 | |
| LCX | 24 | 29.3 | 7 | 38.8 | 0.0817 |
| RCA | 8 | 11 | 2 | 5.6 | |

**Table 12. Comparison between the two studied groups according to hospitalization duration**

| | Group A (n = 81) | Group B (n = 19) | P |
|---|---|---|---|
| **Hospitalization duration (hrs)** | | | |
| Min. – Max. | 2.50 – 7.0 | 0.0 – 10.0 | |
| Mean ± SD | 3.40± 1.023 | 4.33± 2.223 | 0.0008* |

**: Significant as p ≤ 0.05*

**Table 13. Comparison between the two studied groups according to in hospital course follow up**

| | Group A (n = 82) | | Group B (n = 18) | | p |
|---|---|---|---|---|---|
| | No | % | No | % | |
| Advanced HF | 6 | 7.4 | 3 | 15.8 | 0.113 |
| Pulmonary edema | 7 | 8.6 | 3 | 15.8 | 0.025* |
| Cardiogenic shock | 8 | 99 | 9 | 47.4 | <0.001* |
| Complete AV block | 5 | 6.2 | 2 | 10.5 | 0.223 |
| Ventricular arrhythmia | 6 | 7.4 | 5 | 26.3 | 0.013* |
| In- hospital mortality | 2 | 2.5 | 7 | 36.8 | <0.001* |
| Cardiopulmonary resuscitation | 5 | 6.2 | 9 | 47.4 | <0.001* |

**Table 14. ROC curve analysis of TIMI risk index, TIMI risk score and GRACE score to prediction of mortality**

| | Sensitivity | Specificity | PPV | NPV | Standard error | Significance level | AUC |
|---|---|---|---|---|---|---|---|
| TIMI risk index | 100 | 47.80 | 8.6 | 100 | 0.083 | 0.028* | 0.682 |
| TIMI risk score | 100 | 20.0 | 6.2 | 100 | 0.134 | 0.556* | 0.579 |
| GRACE score | 80.0 | 51.6 | 8.0 | 98.0 | 0.120 | 0.300 | 0.624 |

### 3.7 Hospitalization Duration

With a P value of <0.05, there was a statistically significant difference between the two groups. In group A the mean duration for hospital stay was 3.40± 1.023 hrs. compared to 4.33± 2.223 hrs in group B.

### 3.8 In Hospital Course Follow Up

Cardiogenic shock, in-hospital mortality, pulmonary edema, severe ventricular arrhythmia, and cardiopulmonary resuscitations were more prevalent in the no reflow group.

Table 14. shows that TIMI risk index is considered better positive marker than negative in case to predict mortality with higher sensitivity of 100 and specificity 47.80 with AUC 0.682 and P value 0.028.

## 4. DISCUSSION BASELINE CLINICAL CHARACTERISTICS

In our investigation, mean age of group B (NRF) on admission was significantly older than group A (reflow) (60.66 ± 12.77years VS. 52.44±10.792 respectively, p<0.014*). In addition, there is no significant difference between group A (reflow) and group B (NRF) as regards, male gender (42% VS. 57.9% respectively), female gender (58% VS. 42.1% respectively), presence of diabetes (51.9% VS. 47.4%), presence of HTN

(45.7% VS. 31.6% respectively), smoking (42% VS. 52.6%), dyslipidemia (44.4% VS. 57.9% respectively), family history (42% VS. 57.9% respectively), prior IHD or MI (21% VS. 26.3% respectively) and previous PCI (35.8% VS. 47.4% respectively).

Ndrepepa et al. [8] investigated the clinical variables linked with the emergence of the NRF phenomenon following successful cardiac reperfusion in individuals with acute myocardial infarction. The reported mean age and history of previous MI of the no reflow group patients were significantly higher than the reflow group (65.8 vs.61.4 years, p=0.001), and (18.5% vs.11.7%, p=0.041). Meanwhile, there was no significant difference in sex (71.3% vs.75%), current smoking (30.6% vs.40.5%) HTN (66.7% vs.67.3%), dyslipidemia (57.4% vest 58.1%) & prevalence of DM (14.8% vs.20.3%,).

## 4.1 Admission Characteristics

In this trial, concerning ECG, there was no significant difference between group A and B in the location of MI (anterior 53.1% vs. 36.8%, non-anterior, 46.9% vs. 63.2%). SBP was significantly lower in group B (NRF) than group A (reflow) (95.9±11.4 mmHg VS. 110.8 ± 18.7 mmHg), while pulse rate and Killip class were significantly higher in group B (NRF) than group A (reflow) (96±17.8 bpm VS. 88.8 ± 17.5 bpm) (class III-IV 60% VS. 14.9%, class I-II 40% VS. 85.1 %).

Ndrepepa et al. [8] observed that there was no significant difference between the research groups in terms of SBP (125 vs. 130 mmHg), pulse rate (78 bpm in both groups), and location of MI (anterior 41.7 percent vs. 58.3 percent non-anterior). Meanwhile, a significant difference in Killip class was seen between the no-reflow and reflow groups (63 vs. 70.9 percent for class I and 34 vs. 29.1 percent for class II, p=0.019).

According to Ito et al. [9], a statistically significant difference existed between the no-reflow and reflow groups (83.3 vs. 72.1 % for class I, 16.7 vs. 27.9 % for class II, p=0.03).

According to Iwakura et al. [10] there was significant difference between the no reflow and reflow groups based on killip class, pulse rate and location of MI (class I 75.5% vs. 97.9%, class ≥ II 24.5% vs. 2.1%, p=0.03), (85±20 vs. 77±17 bpm, p=0.01) and (anterior MI 83.7% vs. 53.6%, p=0.0002).no significant difference between the two groups regarding mean SBP (126±25 vs. 121±21 mmHg respectively).

In disagreement to our study, Huczek et al. [11] investigated that on admission, there was no significant difference between low MPV and high MPV groups according to Killip class and location of MI (class I 75.8% in both groups), (anterior MI in 45.3% vs. 40.9% respectively).

## 4.2 Duration of Chest Pain

In our investigation, the duration of chest pain from onset to admission was significantly longer in group B (NRF) than in group A (reflow) (5.89±1.99 vs. 4.09 ± 2.15 hours) with a significant P value of 0.001*.

Ndrepepa et al. [8] and Akpek et al. [12] investigated that door to balloon time was significantly longer in the no reflow group than reflow group (the median was 10.7 vs. 6.5 hours, p=0.001) (the mean was 4.8 ±1.3 hours vs. 4.2±1.4 hours, p<0.001) respectively.

In disagreement to our study, Ito et al. [9] and Iwakura et al. [10] stated that door to balloon time was not significantly different in the no reflow group and the reflow group (the mean was 5.8±4.1 hours vs. 6.3±4.5 hours, p=0.41), (the mean was 5.2±4.1 hours vs. 6.1±4 hours, p=0.40).

## 4.3 Cardiac Risk Scores

In our study, we established that TRI was an independent and significant predictor of successful P-PCI by demonstrating that an elevated TIMI risk index (TRI), TIMI risk score (TRS), or GRACE score (GRS) on admission was significantly associated with the development of angiographic no reflow phenomenon, as well as MACEs and length of stay.

Halit et al. [13] examined “if there was a statistically significant difference between the two groups with a P value of 0.05. On admission, the mean values of the TIMI risk index (TRI), TIMI risk score (TRS), and GRACE score (GRS) are greater in the group with no reflow (32.1 ± 15.8, 4.8 ± 2.9, 177.0 ± 51.4) than in

reflow group (25.6 ± 12.5, 3.8 ± 2.2, 151.7 ± 35.4)".

## 4.4 Initial Laboratory Results

### 4.4.1 Cardiac enzymes

With a P value 0. 574, there was no statistically significant difference between the two groups. In our study in group A, the mean CKMB value was 51.40 ± 19.589 mg/dl. While in group B it was 54.26 ± 21.574 mg/dl.

There is no statistically significant difference between the two groups in Halit et al. (2016).'s study.

### 4.4.2 Serum creatinine

There was no statistically significant difference between the two groups in our investigation, as determined by the P value of 0.930.

### 4.4.3 Echocardiographic findings

In our investigation, there was significant difference between the two groups. Concerning EF that was lower in group B (NRF) than group A (reflow) (42.8±6.3 % VS. 52.3±6.2 %), while LVESV was higher in group B than group A (67.4±8.3 ml VS. 63.9±8.9 ml), also LVEDV was higher in group B than group A (195.4±16.3 ml VS. 165.4±15.6 ml).

Ndrepepa et al. (2010) stated that EF was significantly lower in NRF group than reflow group (48±7.5 % VS. 50±7 %, p <0.001).

### 4.4.4 Angiographic findings

In this trial, there was no significant difference in the number of vessels occluded between the two groups. Between groups A and B, there was no significant change in the culprit artery. (RCA 29.3% vs. 38.8%, LAD 59.7% vs. 55.6 percent, and LCX 11% vs. 5.6 percent).

Halit et al. (2016) reported no significant difference in the number of occluded vessels between the reflow and non-reflow groups (1 vessel in 44% vs. 37%, >1 vessel in 56% vs. 63%), IRA (LAD 46 percent vs. 57 percent, LCX 17 percent vs. 4 percent, RCA 37 percent vs. 39 percent).

Iwakura et al. (2003) found that patients with LAD and initial TIMI 0 flow were substantially more likely to be categorized as IRA in the no-reflow group (83.7 vs. 53.6 percent, p=0.0002) and (89.8 vs. 70%, p=0.005).

### 4.4.5 In-hospital course

In this study, in-hospital MACEs were more common in group B (no-flow) than group A (reflow) including serious ventricular arrhythmia (26.3% VS. 7.4%), complete AV block (10.5% VS. 6.2), Cardiopulmonary resuscitation (47.4% VS, 6.2%), pulmonary edema (15.8% VS. 8.6%), cardiac death occurred in (36% vs. 2.5%), cardiogenic shock (47.4% VS. 9.9%).

Halit et al. (2016) Emad reported that "in-hospital MACE was significantly higher in the no reflow group (17 percent vs.44 percent, P 0.001), as were serious ventricular arrhythmia (7 percent vs.19 percent, P 0.001), cardiopulmonary resuscitation (8 percent vs.29 percent, P 0.001), advanced pulmonary edema (4 percent vs.9 percent, P =0.043), cardiac death (7 percent vs.26 percent, P 0.001)" .

## 5. CONCLUSION

This study highlighted the relationship between no-reflow and admission TRI, MACE, and in-hospital mortality in patients undergoing primary percutaneous coronary intervention. TRI has been shown to increase the risk of in-hospital mortality and MACE. To test patients who have had a STEMI, TRI employs simple and cost-effective methods. Furthermore, a high TRI may aid in identifying high-risk patients and providing appropriate treatment solutions.

## 6. STUDY LIMITATIONS

1. The sample size was relatively small and further studies is needed to validate our findings.
2. They do not represent all patients who presented with acute STEMI in our nation, since many patients are still treated solely with fibrinolysis due to cost constraints. Thus, the expected lower death rate for wealthy patients and the forecasted higher death rate for ill patients may compensate for one another.
3. One reason for the delay in doing PCI is that patients must ascertain their financial ability to pay for the surgery.

4. Our findings are based on a single-center experience in which operators are informed and the hospital is equipped with an efficient medical and paramedical staff, as well as an effective ambulance system. These findings may not be applicable to all hospitals in the United States.
5. Cases of cardiac death that have not been fully investigated, by autopsy, for example, in order to precisely characterize and help further avoid the causes of cardiac death in hospital following PPCI.
6. We did not follow up with the NRF patients after they were discharged from the hospital.

## CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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