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Early Resolution of ST-segment elevation after primarypercutaneous coronary intervention and correlation to

in-hospital outcomes.

**This study done by:**

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Introduction:

Primary percutaneous coronary intervention (PCI) is the preferred treatment to restore Flow through the infarct- related coronary artery in patients who present with St-segment elevation myocardial infarction (STEMI)1Resolution of electrocardiographic St-segment elevation after reperfusion therapy for acute myocardial infarction has been correlated with clinical outcomes and recovery of left ventricular function. ST- segment Resolution (STR) is believed to be a measure of microvascular reperfusion and has been increasingly used as a surrogate end point in clinical trials that evaluate new reperfusion strategies for acute myocardial infarction. Despite the use of STR as a surrogate end point, the optimum method for measuring STR and the clinical predictors of STR have not been well defined. Further, there are limited data regarding the correlation between STR and late cardiac mortality and whether this correlation is consistent across subgroups of infarct location 2. Ideally, STEMI patients undergoing primary PCI should be stratified into high- and lower-risk subgroups at the catheterization laboratory before transfer to the nursing department or the referring hospital; but data on the predictive value of early STR are scare. Therefore, we sought to investigate whether early STR, assessed at the end of primary PCI, has short- to long-term prognostic properties in a single-center, all- comer STMI population 3. The success of primary PCI can be assessed angiographicallyby evaluating thrombolysis in myocardial infarction (TIMI) Flow and myocardial blush grade (MBG) in the infarct- related artery, and electrocardiographically by assessing the extent of St-segment Resolution (STR) after PCI. Myocardial blush grade and STR can be evaluated in central core laboratories and provide objective evidence of reperfusion. In different studies, these indicators of reperfusion have been correlated with survival and freedom from major adverse cardiac events (MACE) during follow-up 4.

In patients with ST-segment elevation myocardial infarction (STEMI), thrombolysis has been replaced by primary percutaneous coronary intervention (PCI) as the preferred treatment strategy. Nevertheless, primary PCI only facilitate myocardial reperfusion by restoring coronary epicardial Flow. Microvascular dysfunction is a common complication after “successful” primary PCI and may be induced by distal embolization, reperfusion injury, or bioactive factors causing vasoconstriction downstream. Microvascular dysfunction is quantified by ST-segment recovery as measure on 12-lead electrocardiogram (ECG). As a result, incomplete ST-segment recovery often is a reason to administer adjunctive therapy to increase suboptimal microvascular reperfusion 5.

The fibrinolytic treatment of ST-elevation myocardial infarction (STEMI) is also well established as reperfusion therapy for acute STEMI. The earlier the therapy is initiated, including the prehospital phase, the better the outcome. For both reperfusion strategies, even if antegrade Flow is established, this restoration of Flow in the epicardialinfarct-related artery is not always accompanied by normal perfusion of the myocardium 6.

The endpoints of the research:

Investigate the correlation between Resolution of ST segment elevation in patients with acute ST elevation myocardial infarction and in hospital mortality and cardiogenic shock.

Method:

The Type of our study is retrospectivecollection of ECGs.

The source of our data is the medical records from single center (Nasiriyah Heart Center).

The total number of our population is100

patientsfrom 2018.

Our study population was the patients who had acute ST-elevation myocardial infarction (STEMI), treated by primary percutaneous coronary intervention (PCI).

We study the correlation between ST-segment Resolution (STR) on ECG and in-hospital out comes:

1\_Death

2\_LV-function

3\_ Major adverse cardiac events (MACE)

4\_ Arrhythmia

5\_ TIMI Flow

Result:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | | |
|  | N | Minimum | Maximum | Mean | Std. Deviation |
| age | 100 | 23.00 | 84.00 | 58.0000 | 11.89856 |
| Valid N (listwise) | 100 |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **gender** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 28 | 28.0 | 28.0 | 28.0 |
| 1.00 | 72 | 72.0 | 72.0 | 100.0 |
| Total | 100 | 100.0 | 100.0 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | | |
|  | N | Minimum | Maximum | Mean | Std. Deviation |
| hos | 100 | 1.00 | 12.00 | 3.7500 | 1.86610 |
| Valid N (listwise) | 100 |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **smoking** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 41 | 41.0 | 41.0 | 41.0 |
| 1.00 | 59 | 59.0 | 59.0 | 100.0 |
| Total | 100 | 100.0 | 100.0 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **dm** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 60 | 60.0 | 60.0 | 60.0 |
| 1.00 | 40 | 40.0 | 40.0 | 100.0 |
| Total | 100 | 100.0 | 100.0 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **hypertention** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 46 | 46.0 | 46.0 | 46.0 |
| 1.00 | 54 | 54.0 | 54.0 | 100.0 |
| Total | 100 | 100.0 | 100.0 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Ischmic heart disease** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 76 | 76.0 | 76.8 | 76.8 |
| 1.00 | 23 | 23.0 | 23.2 | 100.0 |
| Total | 99 | 99.0 | 100.0 |  |
| Missing | System | 1 | 1.0 |  |  |
| Total | | 100 | 100.0 |  |  |

8\_ The most common vessel diseased is (LAD) 48%

Second one is RCA 38%

ThenLCX 14% and LMS 1%

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **vessels** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid |  | 1 | 1.0 | 1.0 | 1.0 |
| 1 | 49 | 49.0 | 49.0 | 50.0 |
| 2 | 18 | 18.0 | 18.0 | 68.0 |
| 3 | 25 | 25.0 | 25.0 | 93.0 |
| 4 | 7 | 7.0 | 7.0 | 100.0 |
| Total | 100 | 100.0 | 100.0 |  |

*The site of STEMI:*

Inferior MI 41%

Anterior MI 22%

Anteroseptal MI 10%

Anterolateral MI 9%

Lateral MI 9%

Inferoposterior MI4%

Posterior MI3%

Septal MI 1%

Inferoanterior MI 1%

*9% of the patients take thrombolytic therapy.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **thrombolytic** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 91 | 91.0 | 91.0 | 91.0 |
| 1.00 | 9 | 9.0 | 9.0 | 100.0 |
| Total | 100 | 100.0 | 100.0 |  |

*In-hospital outcomes :*

13% need CPR and 87% don’t need it.

8% died and 92% stable at the hospital.

The blood Flow before intervention is:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **TIMI** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 80 | 80.0 | 80.0 | 80.0 |
| 1.00 | 18 | 18.0 | 18.0 | 98.0 |
| 2.00 | 2 | 2.0 | 2.0 | 100.0 |
| Total | 100 | 100.0 | 100.0 |  |

The blood Flow after intervention is:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **TIMI** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 1 | 1.0 | 1.0 | 1.0 |
| 2.00 | 11 | 11.0 | 11.0 | 12.0 |
| 3.00 | 88 | 88.0 | 88.0 | 100.0 |
| Total | 100 | 100.0 | 100.0 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **maker** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 97 | 97.0 | 97.0 | 97.0 |
| 1.00 | 3 | 3.0 | 3.0 | 100.0 |
| Total | 100 | 100.0 | 100.0 |  |

*VF developed Only in 2% of the patients.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Vf** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 98 | 98.0 | 98.0 | 98.0 |
| 1.00 | 2 | 2.0 | 2.0 | 100.0 |
| Total | 100 | 100.0 | 100.0 |  |

*AF in 7% of the patients.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Af** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 92 | 92.0 | 92.9 | 92.9 |
| 1.00 | 7 | 7.0 | 7.1 | 100.0 |
| Total | 99 | 99.0 | 100.0 |  |
| Missing | System | 1 | 1.0 |  |  |
| Total | | 100 | 100.0 |  |  |

*VT in 3% of the patients.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Vt** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 97 | 97.0 | 97.0 | 97.0 |
| 1.00 | 3 | 3.0 | 3.0 | 100.0 |
| Total | 100 | 100.0 | 100.0 |  |

*12% they need to DC shock.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Dc** | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | .00 | 83 | 83.0 | 89.2 | 89.2 |
| 1.00 | 10 | 10.0 | 10.8 | 100.0 |
| Total | 93 | 93.0 | 100.0 |  |
| Missing | System | 7 | 7.0 |  |  |
| Total | | 100 | 100.0 |  |  |

*ST-segment elevation before primary percutaneous coronary intervention (PCI) :*

The mean of elevation is 3.7%

The minimum is 1 and the maximum is 11

The Standard deviation is 2.06989

*After primary percutaneous coronary intervention (PCI) :*

The mean of depression is 1.7%

The minimum is o and maximum is 6

The Standard deviation is 1.40974

*THE RATIO OF DEPRESSION:*

The mean is 55%

The minimum is 0 and the maximum is 100%

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | | |
|  | N | Minimum | Maximum | Mean | Std. Deviation |
| depresion | 100 | .00 | 6.00 | 1.7500 | 1.40974 |
| eleation | 100 | 1.00 | 11.00 | 3.7200 | 2.06989 |
| ratoi | 100 | .00 | 100.00 | 55.5500 | 32.45864 |
| Valid N (listwise) | 100 |  |  |  |  |

*LV Function :*

Fair LV function 5%

Good function 3%

1% mild hypertrophy

2% moderate hypertrophy

*Discussion:*

The results of our study are similar to those of multiple international studies. This is explainable because early ST segment recovery indicators more efficient survival of the ischemic myocardium; therefore, the end result is thatsmaller area of heart muscles is infarcted leading to somehow preserved myocardial contractility and hence less risk of heart failure. The usability OF ST-SEGMENT RESOLUTION (STR) in STEMI as prognostic tool was well established in the thrombolytic era. The role of STR in the contemporary primary PCI era has been less well characterized because of Limitation in earlier PCI studies, including the non routine use of stents, the lack of data with drug-eluting stents, failure to prospectively standardize the timing of postreperfusion ECGs, and relatively short-term follow up. Previous studies have examined the prognostic value of STR after primary PCI in STEMI, with conflicting results. The CADILLAC investigators reported that the degree of STR after balloonangioplasty and BMS were independent predictors of both 30-day and 1-year death and reinfarction. The Assessment of PEXelizumab in Acute Myocardial Infarction (APEX-AMI) investigators found that the degree of STR at 60 minutes post-PCI was an independent predictor of 30-day mortality in 3403 patients with STEMI. In contrast, the DANAMI-2 investigators compared the long-term prognostic value of STR in 1421 patients treated with fibrinolysis compared with primary PCI, finding that STR at 90 minutes was an important predictor of short—and long-term (4.2 years) mortality after fibrinolysis but not after PCI. Whether the differences between this and previous studies related to patient selection, ECG Analysis methodology, or the examination of outcomes at an early versus late time point is uncertain. Nonetheless, this report raised uncertainty as to short-term prognostic value of STR after primary PCI in STEMI. In the present study, the degree of STR measure 1 minute post-PCI in 100 patients with STEMI was an independent predictor of in patient outcomes(MACE and ischemia-driven TVR) 7.

Our study confirms the powerful predictive value of various measures of immediate ST-segment recovery and in-hospital outcomes in STEMI population undergoing PCI.

In the largest study published until now, ST-segment recovery was strongly associated with 90\_day death, congestive heart failure, and shock.

First, ST-segment recovery in this study was assessed at the end of PCI, before the patients left the catheterization laboratory. In our daily practice, with STEMI patients transported to the catheterization laboratory by ambulance after field triage and subsequent transfer to local hospitals soon after completion of the procedure, early assessment of risk may be essential for further medical strategies and prognosis 8.

In this samples of patients with primary PCI , we found that the following characteristics, available before PCI, were independent predictors of incomplete ST-segment recovery :age, smoking, presence of diabetes mellitus, LAD-related MI, presence of multivessel disease, and preprocedural TIMI Flow. By applying a simplified risk score, we could calculate a patient’sapriori risk of incomplete ST-segment recovery. Patients in the high-risk category had a 2.7-fold higher risk for incomplete ST-segment recovery (62%) than patients in the low-risk category (38%). Further more, incomplete ST-segment recovery was a Powerful predictor of long-term mortality in addition to the above mentioned characteristics that independently predicts incomplete ST-segment recovery.

First, age being an independently predictor of incomplete ST-segment recovery seems reasonable when we acknowledge the time-dependent nature of arteriolosclerosis. The multifactorial cause of microvascular dysfunction(distal embolization, microvascular constriction through release of bioactive factors, vascular or myocyte edema, etc.) may likely be negatively influenced by aging. Second, the inverse Relation between smoking status and occurrence of incomplete ST-segment recovery exemplifies the “smoker’s paradox”, which implies a favorable outcomes of smoker’s with acute MI or heart failure. Third, the independent association between presence of DM and occurrence of incomplete ST-segment recovery is in accordancewith an increased risk of cardiovascular nonfatal and fatal events in diabetic patients. In addition, patients with diabetes have a poorer prognosis compared to their nondiabetic counterparts. Fourth, patients with LAD-related-MI had an adjusted two-fold increased risk of incomplete ST-segment recovery. Differences in ST-segment recovery after primary PCI between patients with anterior and non anterior STEMI were previously reported in subgroub Analysis from the assessment of Pexelizumab in acute myocardial infarction (APEX AMI) trial. Fifth, multivessel disease as an independent characteristiccan be explained by the assumption that more extensive atherosclerosis of epicardialcoronary arteries is associated with more outspoken dysfunction of the myocardial microvasculature, resulting in more frequent incomplete ST-segment recovery. Interestingly, normal TIMI graded Flow before primary PCI was the sixth characteristic independently predictive of incomplete ST-segment recovery. Persistent ST-segment elevation in the presence of TIMI grade 3 Flow through the infarct related coronary artery before primary PCI signals Persistent microvascular dysfunction not responsive to epicardial reperfusion.

Patients at high risk for microvascular dysfunction can be identified with our ST-segment recovery risk score. These patients are a target population for adjunctive therapy. Preproceduralrisk stratification with subsequent Decision making about adjunctive treatment enhances management of patients with STEMI. For example, patients at high risk could especially benefit from glycoprotienIIb/IIIa inhibitors in addition to aspirin, clopidogrel, and unfractionated heparin. In contrast, patients at low risk could benefit from a more restrictive antiplatelet regimen, which decreases the incidence of clinically relevant complications. So, we established that there is a strong and lasting association between early STR and short- to long -term mortality in an unselected STEMI population undergoing primary PCI. Our results confirm and extend the data on the predictive value of early STR in the setting of primary PCI. In these First hours after reperfusion, when ECG changes rapidly, the optimal time of measuring STR has remained unclear. Our findings suggest that, already at the end of PCI, early STR is perfectly capable of predicting mortality at hospital.

Early STR better reflects restoration of myocardial tissue perfusion than TIMI – graded epicardial Flow.

Assessment of early STR has numerous advantages as compared with measurements at a time point between 30 and 240 minutes after PCI procedure. Early STR Assessment enable physicians at the catheterization laboratory to instantly identify high-risk patients, without the time delay associated with patientstransportation to other department of care.

*Limitationsof our study:*

*Firstly, our study is the retrospective collection of ECGs which is weaker than other Type of studies. Also the Number of our samplesis only 100 patients which isnot enough for perfect study, and lastly,we study only inpatient outcomes not long term follow-up.*

*Conclusion:*

Early ST segment resolution is associated with statistically significant improved in-patientoutcomes in terms of mortality, LV function, MACE (Major Adverse Cardiac Events) & TIMI Flow. The routine evaluation of both STR and MB grade for assessing microvascular injury identifies patients at increased risk of death and other adverse events after primary PCI for AMI.

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