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Additive Value Of Three Dimensions Echocardiography Parameters To Grace Score For Predicting Left Ventricular Remodeling Following Revascularization In Acute Anterior St- Elevation Myocardial Infarction – A Comparison Of Primary Angioplasty And Streptokinase-Based Pharmaco-Invasive Strategy

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ABSTRACT

Background: PPCI (Primary percutaneous coronary intervention) is treatment of choice for acute ST-elevation myocardial infarction (STEMI), pharmaco-invasive revascularization is an alternative option when PPCI not accessible within the time.

Aim of the study: Comparing reperfusion strategies in patients with acute anterior STEMI treated by PPCI versus pharmaco-invasive strategy regarding the effect on LV remodeling, safety and efficacy.

Patients and Methods: 100 patients with acute anterior STEMI. At Bab Al Sheria hospital (Al-Azhar University), from April 2019 to January 2021, 50 patients treated with pharmaco-invasive strategy (group I) and 50 patients treated with primary PCI (group II).

Results: Left ventricular remodeling (LVR) occurred in 17 patients (34%) in group I and 15 patients (30%) in group II, (P=0.668), GRACE score was higher in LVR in both groups with cut off value ≥ 142 for all patients, total occlusion of left anterior descending coronary artery (LAD); was found in 30 patients in group II, compared to 8 patients in group I, (p-value<0.001), No reflow occurred in 5 patients in group I, and in 6 patients in group II (p-value=0.749), bleeding complications was higher in group I (P value=0.022*), acute CVA occurred in (6.0%) in group I and (8.0%) in group II (p-value=0.695) and Heart failure occurred in 8 patients in group I and II (p-value=1.000).

Conclusion: pharmaco-invasive strategy has similar effect to PPCI in reduction of LVR post-acute anterior STEMI, and GRACE score can be useful for prediction of LV remodeling.

Keywords: LVR; 3D Echo-cardiography, GRACE risk score; PPCI, pharmaco-invasive PCI

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INTRODUCTION

ST-Segment elevation myocardial infarction, usually occurs when a fibrin-rich clot completely blocks an epicardial coronary artery, and accounts for about 25-40% cases of acute coronary syndrome (ACS).¹

Primary PCI is the recommended reperfusion therapy for (STEMI), because feasibility sometimes makes it difficult to implement this strategy in developing countries, the pharmaco-invasive strategy, in which the patient is given a fibrinolytic and then undergoes coronary angiography (within 3-24 hours after successful fibrinolytic therapy), is seen as an alternative to Primary PCI When it is not available on time.²

Left ventricular remodeling after myocardial infarction is a complex process, including dilation of the Infarcted area, progressive hypertrophy in non-infarcted area and it is precursor for development of heart failure, which is an important prognostic indicator for mortality, there for LVR is a primary target for treatment after acute myocardial infarction.³

Analysis of the left ventricular volumes, geometry has been performed by two dimensional echocardiography (2D ECHO), and this method has limitations related to morphological and functional analysis of heart structures and possibility for foreshortening during image acquisition.⁴

3D echocardiogram can give structural analysis for the heart in multiple spatial levels, LV volumes calculated by 3D echocardiogram software, are three times more accurate than 2D echocardiogram with closer approximation to measurements obtained with better spatial resolution ways, such as 64 - Ultra-fast channel computed tomography and nuclear magnetic resonance.⁵

we aimed by this work was to compare reperfusion strategies in patients presented by acute anterior STEMI treated by PPCI versus pharmaco-invasive strategy regarding the effect on LV remodeling detected by 3D Echocardiography parameter in addition to clinical assessment by GRACE risk score.

PATIENTS AND METHODS

This study included 100 patients presented by acute anterior STEMI. This research was carried out at Bab Al Sheria hospital (Al-Azhar University), between April 2019 to January 2021.

The patients were classified into two groups: Group (1): 50 patients treated with pharmaco-invasive strategy post successful thrombolytic therapy, and Group (2): 50 patients treated with primary PCI.

Inclusion criteria: patients with acute anterior STEMI presented with in 12hours of chest pain onset, treated by primary PCI (door to balloon in 90 minutes) or A streptokinase-based pharmaco-invasive strategy (patients receive streptokinase within 30 minutes of presentation and then coronary angiography done within 3-24 hours after thrombolytic therapy).

Exclusion criteria: patients had history of myocardial infarction, and Previous PCI or Coronary bypass graft, poor echo-window, arrhythmia(atrial fibrillation in particular, as it interferes with the proper analysis of the three-dimensional echo.), mechanical complications of myocardial infarction, circulatory instability, significant valvular, or congenital heart disease or myocardial diseases, inability to follow up and severe non-cardiovascular disease, i.e. (hepato-cellular failure, renal failure, cancer patients receiving chemotherapy) was excluded from the study.

The protocol and all corresponding documents were approved by Ethical and Research committee, Faculty of Medicine, Al-Azhar University and patients provided informed consents. All subjects were exposed to full history taking, general and local cardiac examination, and GRACE risk score assessment.

Acute STEMI was diagnosed according to criteria described in the fourth universal definition of MI when at least two contiguous leads with ST-segment elevation ≥ 2.5 mm in men < 40 years, ≥ 2 mm in men ≥ 40 years, or ≥ 1.5 mm in women in leads V2–V3 and/or ≥ 1 mm in the other leads [in the absence of

left ventricular (LV) hypertrophy or left bundle branch block LBBB].⁶

Vascular (coronary angiographic) assessment:

Coronary angiography was performed. (CAG) to detect coronary artery lesions using a device (Allura Xper FD20, Philips Medical Systems). Infarction related artery confirmation based on result CAG and PCI was done to restore blood flow, we assessed patency of Infarction-related artery, severity of coronary artery disease, TIMI flow (Coronary Artery based on visual evaluation of contrast opacity rate in the affected artery, divided into TIMI 0 And the I And the II And the III) before and after PCI and no reflow (acute reduction in coronary flow in the absence of Dissection, thrombosis, spasm, or high-grade residual stenosis of the target lesion).⁷

Echocardiography

Standard two-dimensional and three dimensions echocardiography were done at baseline (within 24 h after PCI), and at 3-months follow-up. We defined the LV remodeling at three months as an increase in LV end-diastolic volumes (LVEDV) of greater than 20% from baseline study.⁸

Echocardiographic examination was performed using Philips I E33 X Matrix ultrasound machine (S5-1 and X5-1 multi frequency (1 - 5 MHz) matrix array transducers, ECG-gated examination mostly was used to help us during image acquisition and later analysis. Measurements and calculations of different cardiac chambers and ejection fractions were made according to the recent recommendations of the American Society of Echocardiography.⁴

Resting transthoracic echocardiography (2D TTE):

The motion-mode modality (M-mode) was taken from parasternal long axis view to measure linear internal dimensions of the left ventricle (LVIDD, LVIDS), It is carefully obtained perpendicular to the LV long axis, and measured at the level of the MV leaflet tips, The left ventricular volumes were calculated from apical 4-chamber and 2-chamber views according to modified Simpson's method. Ejection fraction (EF) was calculated from estimation EDV and ESV using the following formula: $EF = (EDV - ESV) / EDV$. Resting regional wall motion abnormality assessment by two observer from all acquired 2-D views, The 16 segment model of myocardial segmentation was used; each segment is then scored, using the following criteria: Normokinesia (1 point): normal wall thickening and endocardial excursion, Hypokinesia (2 points): reduced wall thickening, reduced endocardial excursion, Akinesia (3 points): absence of either wall thickening or endocardial excursion and Dyskinesia (4 points): systolic outward stretching or thinning.⁴

Measurements by 3D Echocardiography:

3D images were acquired in real time (RT) by X5-1 probe. All echocardiographic images were digitally stored; measurements of LV volumes done offline using (QLAB advanced software package (Q Lab Version 9.0 3DQ Advanced software, Philips), by two independent observer. The acquisition of the 3D images was carried out after the 2D echocardiographic study. The 3D images were obtained in expiratory apnea with the image attached to the ECG record. The full volume data of the LV was organized into orthogonal four, two chamber, and short axis views. End diastolic and end systolic frames were selected. Mitral annular and apical points were placed on these images. Semi-automated LV endocardial border detection software on Q Lab outlined the endocardial borders in these three planes. The software then used sequence analysis to track the endocardium in all frames and then automatically calculate a true 3D EDV, ESV, and EF from the moving 3D endocardial shell, the left ventricular remodeling was defined as an increase in 3D echocardiographic LV end-diastolic volume (LVEDV) of greater than 20% from baseline study⁹ (Figur 1).



Fig 1: Advanced cardiac 3D quantification.

Statistical analysis:

Recorded data were analyzed using the SPSS; version 20.0. Quantitative data were expressed as mean \pm standard deviation (SD). Qualitative data were expressed as frequency and percentage. Probability (P-value) P-value <0.05 was considered significant-value <0.001 was considered as highly significant and P-value >0.05 was considered insignificant. Receiver operating characteristic (ROC curve) analysis used to find the overall predictively of parameter in and to find out the best cut-off value with detection of sensitivity and specificity at this cut-off value.

RESULTS

In terms of demographic data, there were statistically negligible differences between the two groups, mean age in Group I was 56.70 ± 6.16 years compared to 54.70 ± 7.97 years in Group II with (p-value 0.163).

Thirty seven patients (74%) in Group I were males and 13 patients (26%) were females, while in group II 37 patients (74%) and 13 patients (26%) were male and female respectively. Also, the two groups were comparable in body mass index with the mean in each of Group I and Group II was 33.03 ± 2.69 Kg/m² compared to 32.91 ± 2.30 Kg/m² respectively with (p-value 0.805). As regard risk factors, there were insignificant difference between the two groups (p >0.05 non-significant) (Table 1).

Two dimensional echocardiographic data: the two groups were comparable according to conventional (2DTTE) parameters at baseline and follow up studies, the mean LVEDD \pm SD in Group I at baseline study was 5.39 ± 0.24 cm and in follow up study after three months was 5.36 ± 0.50 cm, while the mean LVEDD \pm SD in group II at baseline was 5.36 ± 0.28 cm and at follow up it was 5.30 ± 0.45 cm (p-value=0.427). The mean LVESD \pm SD in Group I at baseline study was 4.16 ± 0.29 cm and at follow up study was 4.07 ± 0.57 cm, while the mean LVESD \pm SD in group II at baseline study was 4.90 ± 0.65 cm and follow up after three months was 4.59 ± 0.56 cm (p-value 0.353), mean EF% in group I at baseline study was $(39.78 \pm 4.30\%)$ and at follow up was $43.28 \pm 6.14\%$, while mean EF% in group II at baseline study was $41.12 \pm 3.45\%$ and at follow up was $45.04 \pm 5.74\%$, (p-value 0.142). Also, the two groups were comparable according to degree of mitral regurgitation at baseline and follow up studies, in group I 38 patients (76%) and 12 patients (24%) had mild and moderate mitral regurgitation respectively compared to Group II were 41 patients (82%) and 9 patients (18%) had mild and moderate mitral regurgitation respectively (p=0.461).

Three dimensional echocardiographic data:

LV remodeling was diagnosed in 17 patients (34%) in group I and in 15 patients (30%) in group II p-value=0.668 (Table 2).

Although, there were statistically considerable differences between changes occurred at baseline and follow up 3D dimensions echocardiographic LVED volume (P=0.026), and WMSI (P=0.015) in group I and in LVED volume (P=0.0096), LVES volume (P=0.008), and WMSI (P=0.022) in group II, there were insignificant differences between all 3D echocardiographic parameters between the two study groups at baseline studies (table-3). The only exception was LVES volume in baseline study, where it was 75.06 ± 17.83 ml in group I, and was 71.58 ± 16.85 ml in group II (p-value= 0.033).

Average left ventricular end diastolic volume (LVEDV) at baseline studies, in group I (pharmacoinvasive) was 120.72 ± 10.84 ml, and in group II (primary PCI) it was 116.97 ± 10.24 ml, while at follow up studies, it was 126.56 ± 20.47 ml in group I and in group II it was 123.16 ± 18.21 ml. P values for comparisons of all parameters between two study groups were >0.05 . 0.078). Left ventricular end systolic volume (LVESV) at baseline in group I was 73.46 ± 9.48 ml, while in group II it was 69.69 ± 7.87 ml (p-value= 0.033), at follow up studies, it was 75.06 ± 17.83 ml in group I, and was 71.58 ± 16.85 ml

in group II ($P=0.318$). Both groups also were comparable in ejection fraction% with the mean in Group I at baseline was $40.00\pm 3.37\%$, while in group II mean EF% at baseline was $40.56\pm 3.41\%$ and follow up values was $41.60\pm 5.60\%$ in group I, while in group II it was $42.99\pm 6.18\%$ (P values > 0.05).

Mean Wall motion score index (WMSI) in group I at baseline was (1.95 ± 0.17) and in group II mean WMSI at baseline was (1.94 ± 0.18), and at follow up it was (1.85 ± 0.26) in group I, while and follow up was (1.84 ± 0.27) in group II (P values > 0.05) (Table 3).

short term follow up clinical outcome: bleeding risk occurred in 5 patients (10%) in group I, and one patient (2%) in group II, (P -value= 0.022), No patients had re-infarction in both groups, acute CVA occurred in 3 (6.0%) in group I compared to 4 (8.0%) in group II, (p -value= 0.695), Heart failure symptoms occurred in 8 (16.0%) in group I and group II (p -value= 1.000) (Table 4).

ROC curve to predict Left ventricular remodeling using the Grace Score used to define the best cut off value of GRACE score which was ≥ 139 in group I, with sensitivity of 100% specificity of 57.6% positive predictive value of 54.8%, negative predictive value of 100% with diagnostic accuracy of 83%, in group II was ≥ 142 , with sensitivity of 86.7% specificity of 60% positive predictive value of 48.1%, negative predictive value of 91.3% with diagnostic accuracy of 75.6% and in all patients groups best cut off value of Grace Score which was

≥ 142 , with sensitivity of 93.7% specificity of 58.8% positive predictive value of 51.7%, negative predictive value of 95.2% with diagnostic accuracy of 79.1%. (Tables 5 and 6), Figure (2)

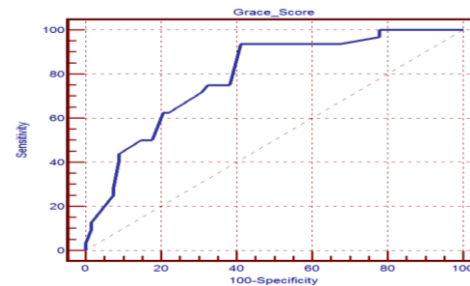


Fig 2: Receiver-operating characteristic (ROC) curve for prediction of Left ventricular remodeling using the Grace Score in all patients

Coronary angiography results: total occlusion of left anterior descending coronary artery (LAD); was found in 30 patients (60%) in group II, compared to 8 patients (16%) in group I, (p -value <0.001), TIMI III flow post revascularization obtained in 33 (66.0%) in group I and in 29 (58.0%) in group II, (p -value= 0.670), No reflow occurred in 5 patients in group I, and in 6 patients in group II, (p -value= 0.749).

Demographic data and Risk Factors	Group I: Pharmacoinvasive (n=50)	Group II: Primary PCI (n=50)	Test	p-value
Age (years)				
Mean \pm SD	56.70 \pm 6.16	54.70 \pm 7.97	t=1.404	0.163
Range	42-67	32-72		
Sex				
Female	13 (26.0%)	13 (26.0%)	x ² =0.000	1.000
Male	37 (74.0%)	37 (74.0%)		
DM	24 (48.0%)	23 (46.0%)	x ² =0.040	0.841
HTN	32 (64.0%)	33 (66.0%)	x ² =0.044	0.834
Dyslipidemia	50 (100.0%)	50 (100.0%)	x ² =0.000	1.000
Smoker	27 (54.0%)	31 (62.0%)	x ² =0.657	0.418
Family history	6 (12.0%)	7 (14.0%)	x ² =0.088	0.766
BMI [wt./ (ht) ²]				
Mean \pm SD	33.03 \pm 2.69	32.91 \pm 2.30	t=0.248	0.805
Range	29-41	29-38.7		

Table 1: Comparison between Group I and Group II according to demographic data and risk factors.

Left Ventricular Remodeling (LVR)	Group I: Pharmaco-invasive (n=50)	Group II: Primary PCI (n=50)	x ²	p-value
Without Left ventricular Remodeling	33 (66.0%)	35 (70.0%)	0.184	0.668
With Left ventricular Remodeling	17 (34.0%)	15 (30.0%)		

Table 2: Comparison between group I and Group II according to percentage of left ventricular remodeling (LVR).

3D Three dimensions echocardiography	Group I: Pharmacoinvasive (n=50)					Group II: Primary PCI (n=50)				
	Baseline	Follow Up	Paired Sample t-test			Baseline	Follow Up	Paired Sample t-test		
	Mean±SD	Mean±SD	Mean Diff.	t-test	p-value	Mean±SD	Mean±SD	Mean Diff.	t-test	p-value
Left ventricular end diastolic volume	120.72±10.84	126.56±20.47	5.85±2.54	-2.303	0.026*	116.97±10.24	123.16±18.21	-.19±2.27	-7.29	0.009*
Left ventricular end systolic volume	73.46±9.48	75.06±17.83	-.60±2.37	-0.674	0.503	69.69±7.87	71.58±16.85	-.89±2.24	-.845	0.402
Ejection fraction%	40.00±3.37	41.60±5.60	-1.60±0.83	-1.915	0.061	40.56±3.41	42.99±6.18	2.43±0.88	-2.77	0.008*
Left ventricular mass index	113.94±14.30	111.65±13.08	2.29±1.56	1.473	0.147	113.90±10.11	112.02±11.45	1.88±1.19	1.583	0.12
Wall motion score index	1.95±0.17	1.85±0.26	0.10±0.04	2.526	0.015*	1.94±0.18	1.84±0.27	0.10±0.04	2.359	0.022*

Table 3: Differences between baseline and follow up studies according to 3D three dimensions echocardiographic parameters in both groups.

Clinical Follow Up	Group I: Pharmaco-invasive (n=50)	Group II: Primary PCI (n=50)	x ²	p-value
Re-infarction	0 (0.0%)	0 (0.0%)	0.000	1.000
CVA	3 (6.0%)	4 (8.0%)	0.154	0.695
Bleeding	5 (10.0%)	1(2.0%)	5.263	0.022*
Heart failure symptoms	8 (16.0%)	8 (16.0%)	0.000	1.000

Table 4: Comparison between Group I and Group II, according to short term Clinical Follow up..

GRACE Score	Group Ia: with Left ventricular Remodeling (n=17)	Group Ib: without Left ventricular Remodeling (n=33)	t-test	p-value
Mean±SD	152.53±7.53	140.30±9.93	-4.45	<0.001**
Range	143-166	123-163		

Table 5: Comparison between subgroups Ia and Ib according to GRACE Score in group I

GRACE Score	Group IIa: with Left ventricular Remodeling (n=15)	Group IIb: without Left ventricular Remodeling (n=35)	t-test	p-value
Mean±SD	150.00±9.09	139.26±11.93	-3.115	0.003*
Range	132-160	117-159		

Table 6: Comparison between subgroups IIa and IIb according to GRACE Score in group II

DISCUSSION

Our study include 100 patients with anterior STEMI, post PCI, all subjects were examined by transthoracic 2D and 3D echocardiography within 24 hours post admission as a baseline study, and three months later as a follow up study, the following parameters were compared (LVEDV, LVESV, EF% WMSI, LVMI). LVR were defined as $\geq 20\%$ increase in LV end-diastolic volume (LVEDV) and/or end-systolic volume (LVESV) at 3-month follow-up compared with the baseline examination after AMI.⁸

In our study, the left ventricular remodeling occurred in 17 patients (34%) in group I (pharmacoinvasive group) and in 15 patients (30%) in group II

(primary PCI group), (p= 0.668). Although we don't know studies directly compare the effect of reperfusion strategy on left ventricular remodeling defined by 3D echocardiography, we tried to compare our results with other studies used another assessment modalities. Kaushik et al., 2018¹⁰; included 33 patients with acute STEMI treated with Primary PCI and 30 patients treated with Pharmacoinvasive PCI; 2D Echocardiography was done at the time of discharge, 30 days after and at 6 months to evaluate the Left Ventricular systolic function at the time of discharge after PCI, 1 month and 6 months after PCI and when they compared pre-intervention EF and Post intervention EF before discharge in Primary PCI group revealed improvement from mean of 42.60% to 46.76% with statistical significant p

value of 0.0025, at 1 month mean EF was 52.13 (p value 0.0001) and at after 6 months EF was 54.80 with p value 0.0001 compared to pre-interventional value, when Ejection Fraction was compared in Pharmaco-invasive Group in different time period, pre-intervention EF and Post intervention EF before discharge revealed improvement in EF from 48.36% to 51.06% with p value of 0.06. At 1 month the LVEF was 52.86% (p value of 0.0047) and at 6 months 54.23% with p value of 0.0007).

Ola et al.¹¹ study included 45 patients of acute ST elevation MI (STEMI), who were treated with primary PCI, their results showed that sixteen (38%) patients had LVR. Three dimensional Echocardiographic measurements up to 7 days post myocardial infarction (AMI) showed that LVEDV in ventricular remodeling group was (99.8 ± 19.1) ml and in no ventricular remodeling group was (87 ± 18.2) mL, (P = 0.037); and LVEF was (0.48 ± 0.01) and (51 ± 0.02) (P < 0.001). After 6 months the LVEDV in remodeling group was (114.2 ± 19.5) mL and no remodeling group was (94.2 ± 18.6) (P = 0.002), and LVEF was (0.58 ± 0.01) and (59 ± .01) (P = 0.003).

In our study bleeding complications was higher in pharmaco-invasive than primary PCI group, as in Group I: 5 patients (10%) three (6%) had mild bleeding at site of vascular puncture without significant drop of hemoglobin level and did not require blood transfusion, and two patients (4%) had major bleeding with drop of hemoglobin level ≥ 5 g/dL and required blood transfusion, compared to Group II: one patient (2%) major bleeding required blood transfusion, (p-value < 0.05). And also Acute CVA occurred in 3 (6.0%) in group I compared to 4 (8.0%) in group II, (p-value = 0.695) and Also congestive heart failure symptoms occurred in 8 (16.0%) in group I compared to 8 (16.0%) in group II with (p-value = 1.000).

Those results were comparable to a large clinical Strategic Reperfusion Early After Myocardial Infarction (STREAM) trial, posted by Frans et al. 2013¹², the study include 944 patients treated by pharmaco-invasive strategy, versus 948 treated by primary PCI, the results revealed that All-cause death, MI, shock, or congestive heart failure at 30 days occurred in 12.4% of the fibrinolysis group versus 14.3% of the primary PCI group (p = 0.21), Re-infarction: occurred in 2.5% vs. 2.2% (p = 0.74), respectively, Congestive heart failure: 6.1% vs. 7.6% (p = 0.18), respectively, Total strokes: 1.6% vs. 0.5% (p = 0.03), respectively, Intracranial hemorrhage: 1.0% vs. 0.2% (p = 0.05), respectively, Major non-intracranial bleeding: 6.5% vs. 4.8% (p = 0.11), respectively. Also our results were in agreement with a study done by Shahin et al.¹³ as the incidence of congestive heart failure was 9% in PPCI group versus 13% (p = 0.366) in pharmaco-invasive group, No cases of re-infarction were recorded during hospital admission. Bleeding complications were more significant in group II than group I, 19 patients (19%) in group II versus 6 patients (6%) of group I (p = 0.005).

We found in our study that there was a strong correlation between occurrence of LV remodeling and clinical GRACE score assessment as it was higher in LV remodeling group with Mean(152.53 ± 7.53) than the group without LV remodeling with Mean(140.30 ± 9.93) (p-value < 0.001) and Grace Score indices were significant predictors for LVR as in (ROC) curve analysis, there was used to define the best cut off value of Grace Score which was ≥ 142, with sensitivity of 93.7% specificity of 58.8% positive predictive value of 51.7%, negative predictive value of 95.2% with diagnostic accuracy of 79.1%. Also the time post successful thrombolytic therapy until PCI affects occurrence of LV remodeling as our study showed incidence of LV remodeling was higher in patients with delayed time ≥ 12 hrs. especially in those with high GRACE score, as percentage of LV remodeling occurred in 29.3% of patients with PCI done in time post streptokinase < 12 hrs, while percentage of LV remodeling occurred in 55.6% of patients with PCI done in time post streptokinase ≥ 12 hrs. The mean GRACE score was higher in LV remodeling group (153.00 ± 7.78) compared to non-remodeling group (140.62 ± 10.27) (p-value < 0.001)

These results were in agreement with Chotechuang et al.¹⁴ studied the ability of GRACE risk score in prediction of cardiovascular event rate in STEMI patients with successful fibrinolysis and delayed PCI (during 24 h to 14 days after successful fibrinolytic therapy in non PCI-capable hospital, total of 152 patients were included. 88 patients were in low GRACE group (GRACE risk score ≤ 125) and 64 patients were in intermediate to high GRACE group (GRACE risk score above 126), the composite cardiovascular outcome at 1 month occurred in 2 patients (2.3 %) in low GRACE group and 10 patients (15.6 %) in intermediate to high GRACE group (P = 0.003). During 6 months, the composite cardiovascular outcomes occurred in 6 patients (6.8 %) in low GRACE group and 12 patients (18.7 %) in intermediate to high GRACE group (P = 0.024), They concluded that: GRACE risk score may be useful and direct the clinicians in non PCI-capable center in early intervention in STEMI patients after fibrinolytic therapy.

CONCLUSION

The effect of pharmaco-invasive strategy is nearly equal to effect of primary PCI in reduction of LVR post-acute anterior STEMI, GRACE risk score assessment may be helpful as a guiding tool for early intervention post successful thrombolytic therapy in pharmaco-invasive strategy before 12 hours as a high GRACE score associated with reverse LV remodeling in delayed intervention ≥ 12 hours. Slightly increased bleeding risk with pharmaco-invasive strategy, with same effect regarding development of acute CVA, congestive heart failure and re-infarction during three months follows up post myocardial infarction.

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