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Original article

Impact of High Intensity Statin Preloading on Outcome of Primary Percutaneous Coronary Intervention in Patients with ST Elevation Myocardial Infarction

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Abstract

Background: Worldwide, ischemic heart disease (IHD) is the single most common cause of death, and its frequency is increasing, now accounts for almost 1.8 million annual deaths. This study aimed to determine the impact of high intensity statin preloading on angiographic and electrocardiographic short-term outcomes of primary percutaneous coronary intervention in patients with ST elevation myocardial infarction (STEMI). **Methods:** This single center, prospective open label randomized controlled study was conducted on 210 patients with STEMI who was planned for primary percutaneous intervention at the Department of Cardiology, Universal Health Insurance Tertiary hospital, Port Said in the duration from May 2023 to May 2024. Patients were randomized into three groups at a ratio of 1:1:1. Follow-up was conducted at 1, 2, and 3 months post-procedure to assess outcomes. We used simple randomization method: Opaque sealed envelopes containing sequential numbers were given to the study patients, according to which each patient was enrolled to one of the three groups: Group I (N=70): Patients did not receive statin before primary percutaneous coronary intervention (PPCI), Group II (N=70): Patients received 80 mg atorvastatin single dose before PPCI, and Group III (N=70): Patients received 40 mg rosuvastatin single dose before PPCI. **Results:** Hypertension and Atorvastatin/ Rosuvastatin were the only significant predictors for the changes in corrected TIMI frame count (CTFC). Diabetes mellitus and Atorvastatin/ Rosuvastatin were the only significant predictors for the changes in Myocardial blush grade (MBG). **Conclusion**: Administering atorvastatin 80mg or Rosuvastatin 40mg before primary PCI in acute MI patients significantly improved angiographic outcomes (CTFC, TIMI flow grade, and MBG) and electrocardiographic outcomes than no statin therapy.

Keywords: High Intensity Statin; Primary Percutaneous Coronary Intervention; ST Elevation Myocardial Infarction

Introduction

Worldwide, ischemic heart disease (IHD) is the single most common cause of death, and its frequency is increasing, now Accounts for almost 1.8 million annual deaths (1).

Acute ST-segment elevation myocardial infarction (STEMI) is a serious and multiple acute cardiovascular disease. The occurrence of STEMI is mainly due to the rupture, excessive activation, and accumulation of unstable plaques in the coronary arteries, forming clots that block the coronary arteries, leading to myocardial ischemia and irreversible damage to myocardial cells. STEMI poses a serious threat to the lives of patients. In recent years, the incidence of STEMI has continuously increased as the population ages and poor lifestyle habits increase. Therefore, the safe and effective treatment of STEMI is crucial (2).

Previous evidence suggests that statins have various favorable effects on vascular system that are not directly related to their impact on lipid metabolism. Beyond lowering lipids, statins have favorable effects on platelet adhesion, thrombosis, endothelial function, plaque stability, and inflammation. As with ACS, the vascular injury from coronary angioplasty and stent placement induces platelet activation, thrombosis, and inflammation within the vessel wall and the distal microvasculature. Therefore, in addition to a long-term benefit associated with lipid lowering, statin therapy might play a beneficial role early after PCI (3).

Enhanced-dose atorvastatin for STEMI patients improved PCI treatment effect, cardiac function, and vagus nerve function and reduced the incidence of adverse cardiac events. Thus, statins are safe and worth considering (2).

Conventional TIMI flow grading (thrombolysis in myocardial infarction) is a predictor of cardiac outcome after acute myocardial infarction and PCI, but it has several limitations. Evaluation of blood flow can be done in various ways and TIMI frame count is a readily available and inexpensive method for estimating the coronary blood flow velocity. The CTFC (corrected TIMI frame count) another approach to grade flow impairment, is an objective, quantitative, reproducible, and sensitive index for coronary blood flow. In order to calculate the CTFC, the angiographic films were taken (30 frames per second) and contrast media injection was performed. Calculation of CTFC was performed by dividing of TFC in the left anterior descending (LAD) artery by 1.7 as it is longer than right coronary artery (RCA) and left circumflex artery (LCX) by 1.7 times (4).

Thrombolysis in Myocardial Infarction (TIMI) flow grade (TFG) 3 was defined as complete coronary flow within three cardiac cycles, whereas TFG <3 denoted incomplete perfusion or complete

perfusion over three cardiac cycles. The corrected TIMI frame count (CTFC) was calculated using the method previously described in which the frames were counted according to the contrast that flowed from the ostium of the target vessel to the distal landmark branch. TIMI flow may appear normal visually but may correlate to abnormal CTFC. The CTFC has been proposed to have incremental prognostic accuracy in predicting survival outcome with reperfusion therapy. Higher CTFC values after PCI have also been found to be associated with poor clinical outcomes (5).

Myocardial perfusion can be assessed in many ways but the most studied of these is myocardial blush grade (MBG). First described by van' t Hof et al. in 1998, MBG is determined on the angiograms made immediately after primary coronary angioplasty using the best projection angles to assess the myocardial region of the infarct-related coronary artery. Unlike TIMI flow grade, which evaluates blood flow along the main epicardial artery, MBG evaluates the microvascular patency of the distal capillaries perfusing the myocardium (6).

The purpose of this study was to determine the impact of high intensity statin preloading on angiographic and electrocardiographic outcome of primary percutaneous coronary intervention in patients with ST elevation myocardial infarction.

Patients and methods

This single center, prospective open label randomized controlled study was conducted on 210 patients with ST-Segment Elevation Myocardial Infraction (STEMI) who was planned for primary percutaneous intervention at the Department of Cardiology, Faculty of Medicine, Benha University and Universal Health Insurance (UHI) Tertiary hospital, Port Said in the duration from May 2023 to May 2024

An informed written consent was obtained from the patients. Every patient received an explanation of the purpose of the study and had a secret code number. The study was done after being approved by the Research Ethics Committee, Faculty of Medicine, Port Said University.

Inclusion criteria were patients with age of 18 to 70 years, both sexes, and patients were diagnosed with STEMI, with present symptoms (<12h), patients were planned for PCI at universal medical insurance at tertiary hospital and had a history of chest pain and an ECG suggestive of STEMI (new ST elevation in two contiguous leads by 0.1 mV or more) from 30 min before admission to 12 h before hospital admission.
The fourth universal definition of myocardial infarction (MI) introduces several changes and new concepts of MI to enhance clinical practice. The most important of them being, in the opinion of the authors herein, the distinction between MI and myocardial injury as

well as an emphasis on the utility of imaging techniques — cardiovascular magnetic resonance (CMR) in defining etiology of myocardial injury and coronary computed tomography angiography in the diagnosis of MI (7). STEMI is a severe acute coronary syndrome characterized by complete or near-complete coronary artery occlusion, resulting in prolonged myocardial ischemia and subsequent necrosis of the affected heart muscle. STEMI is typically diagnosed based on electrocardiographic changes, specifically ST-segment elevation, in conjunction with clinical symptoms and cardiac biomarker elevations, such as troponin (8).

Exclusion criteria were patients > 18 years old or < 70 years old, pregnancy, previous (within 3 months) or current treatment with statins, known allergy to heparin, aspirin, clopidogrel, or statins, active severe bleeding, and cardiogenic shock with mechanical ventilation.

Randomization

Two hundred ten patients were randomized into three groups at a ratio of 1:1:1. We used simple randomization method: Opaque sealed envelopes containing sequential numbers were given to the study patients, according to which each patient was enrolled to one of the three groups: Group I (N=70): Patients did not receive statin before PPCI, Group II (N=70): Patients received 80 mg atorvastatin single dose before PPCI, and Group III (N=70): Patients received 40 mg rosuvastatin single dose before PPCI. This an open labelled study due to usage of different medications or different techniques.

All studied cases were subjected to the following**: Demographic data collection from each patient, including** [age, sex, residence, occupational and education]. **Complete history and co-morbidities taking from each patient included** [Hypertension (HTN) was considered as blood pressure >140/90 mmHg or on antihypertensive medications (9), Diabetes mellitus was considered as fasting blood glucose > 126 mg/dl or post prandial > 200 mg/dl or HbA1c >6.5 or on diabetic therapy (10), Dyslipidemia, considered as total cholesterol > 200 mg/dl, triglycerides > 150 mg/dl, LDL > 130 mg/dl, HDL < 40 mg/dl or on statin therapy (11), Obesity was defined by body mass index above 30 and by waste circumference 102 cm in males and 88 cm in females, Smoking during the last month was considered current smoking, Drug medications, Family history of coronary artery disease (CAD), Previous history of CAD or coronary artery bypass graft, and Previous atherosclerotic cerebrovascular events]. **Physical examination, including** [Analysis of complaint (Onset, course, duration, radiation, exaggerating and relieving factors, and Vital signs include body temperature, heart rate, respiratory rate and systolic and diastolic blood pressure], and **Routine laboratory investigations:** [Complete blood count (CBC), Liver function test, Kidney function test,

Random blood sugar (RBS), and Cardiac biomarkers (troponin I, creatine kinase-myocardial band [CK-MB].

Electrocardiography:

Twelve lead surface ECG was done for each patient. In the appropriate clinical context, a STEMI is diagnosed clinically when there is new (or increased) and persistent ST-segment elevation in at least two contiguous leads of ≥1 mm in all leads other than leads V2-V3 where the following cut-off points apply (12): ≥2.5 mm in men <40 years old: [≥2 mm in men >40 years old, ≥1.5 mm in women regardless of age].

1 mm = 1 small square (at a standard ECG calibration of 10 mm/mV) Contiguous ECG leads lie next to each other anatomically and indicate a specific myocardial territory.

Coronary angiography:

Invasive intervention was done for all patients either as a primary PCI within 90 minutes of admission or as an early invasive PCI after thrombolysis

PPCI:

Primary PCI was performed based on current guidelines. Patients were administered a loading dosage of aspirin 300 mg and clopidogrel 300 mg or ticagrelor 180 mg. All patients were re-evaluated 1, 2, and 3 months after the start of treatment in terms of predicted outcomes.

After the end of the procedure all of the artery containing the fresh thrombus and matches the distribution of STEMI in the ECG, thrombolysis in myocardial infarction (TIMI) flow grade was measured from 0 – 3 after PCI and Myocardial Blush Grade (MBG) was measured from 0 – 3 after PCI.

Coronary angiography to identify their coronary anatomy, the culprit vessel causing the infarction, their TIMI flow score, and TIMI myocardial blush grade. Myocardial blush grade (MBG) is defined as the amount of contrast opacification of the myocardium supplied by the infarct-related artery (IRA) in relation to its supplying epicardial density as seen by the operator.

Outcomes:

Angiographic parameters: [CTFC (Corrected TIMI frame count): In the CTFC method, the number of frames required for dye to reach a standardized distal landmark is counted. A correction factor is required to compensate for the longer length of the left anterior descending artery (LAD) compared with the circumflex and right coronary arteries (the number of frames required for dye to traverse the LAD is divided by 1.7). The frame count number after adjustment for vessel length is given the term 'corrected TIMI frame count' (13), Thrombolysis in myocardial infarction (TIMI) flow grade (TFG), and Myocardial Blush Grade (MBG).

Electrocardiogram parameters: [ST-segment resolution (STR): ST-segment resolution (STR) was calculated as the sum of ST-segment elevation on initial ECG minus the sum of ST-segment elevation on the ECG at 90 min after PCI, divided by the sum of ST- segment elevation on initial ECG, and was expressed as a percentage. The complete early STR was defined as more than or equal to 70% STR (13), and Post-angioplasty QRS duration change: QRS duration change post angioplasty is a strong marker of myocardial reperfusion in patients presenting with STEMI (14)].

Approval Code: MS 22-5-2023

Sample size calculation

The sample size was calculated using Power and sample size software version 3.1.2 based on a study by (15) who reported a TIMI flow III of 95.3% and 80% in patients received high-intensity statins and those who did not receive statins, respectively. The total sample size was 210 individuals (70 per group). Alpha and power were adjusted at 0.05 and 0.8, respectively.

Statistical analysis

All data were collected, tabulated and statistically analyzed using SPSS 20.0 for windows (SPSS Inc., Chicago, IL, USA) & MedCalc 13 for windows (MedCalc Software bvba, Ostend, Belgium). Continuous Quantitative variables were expressed as the mean ± SD & median, and categorical qualitative variables were expressed as absolute frequencies (number) & relative frequencies (percentage). Continuous data were checked for normality by using Shapiro Walk test. Mann-Whitney. All tests were two sided. P-value<0.05 was considered statistically significant (S), p-value <0.001 was considered highly statistically significant, and p-value ≥0.05 was considered statistically insignificant (NS). Multivariate logistic regression Logistic regression is also used to estimate the relationship between a dependent variable and more independent variables

Case

Male patient 65 years old smoker, not hypertensive and not diabetic with history of IHD on medical treatment and positive family history of CAD. Complaining of retrosternal squeezing chest pain for 1 hr. duration with maximal intensity at the time of examination, radiating to his left arm, and associated with sweating.

Vital signs were accepted in the form of: BP: 140/80, HR: 88 bpm, Temp: 36.7, RR: 18, RBS: 200. **Figure 1**

Results

In this study, 249 patients were assessed for eligibility, 27 patients did not meet the criteria and 12 patients refused to participate in the study. The remaining 210 patients were randomly allocated into 3 equal groups (70 patients in each). All allocated patients were followed-up and analyzed statistically. **Figure 2**

Baseline characteristics, risk factors including family history, diabetes mellitus, hypertension, hyperlipidemia, CKD and IHD, medications, the diagnosis (STEMI territory), clinical examination of vital signs, and RBG were insignificantly different among the studied groups. Smoking was significantly different among the studied groups (P=0.037), being higher in group 3 compared to other groups. **Table 1**

Regarding the angiography finding, initial CTFC, CTFC after PCI was significantly lower in group 2 compared to group 1 (P=0.003), with no significant difference between groups 1&3 and between groups 2&3. TIMI flow after PCI was significantly better in group 3 compared to group 1 (P<0.001), was better in group 2 compared to group 1 but with no significant difference between groups 2&3. MBG after PCI was significantly higher in groups 2&3 compared to group 1 (P=0.008, 0.018), with no significant difference between groups 2&3. There was no significant difference among the studied groups regarding other angiographic findings (initial TIMI flow, initial MBG and Culprit vessel).

The mean STR after PCI was significantly higher in groups 2 and 3 compared to groups 1 (P<0.001, 0.010), and was insignificantly different between groups 2&3. There was an insignificant difference among the studied groups regarding the pre-, post and the change in the QRS duration. **Table 2**

The multivariate logistic regression analysis revealed that hypertension and Atorvastatin/ Rosuvastatin were the only significant predictors for the changes in CTFC. The multivariate logistic regression analysis revealed that diabetes mellitus and Atorvastatin/ Rosuvastatin were the only significant predictors for the changes in MBG **Table 3**

Table 1: Baseline characteristics, risk factors, medication (Preloaded with ASA 300 mg), diagnosis (STEMI territory), clinical examination of vital signs, and random blood glucose of the studied groups

		Group 1 (n=70)	Group 2 (n=70)	Group 3 (n=70)	P value
Age (years)		55.96 ± 10.03	57.8 ± 9.22	56.99 ± 9.73	0.538
Sex	**Male**	52 (74.29%)	45 (64.29%)	42 (60%)	0.186
	Female	18 (25.71%)	25 (35.71%)	28 (40%)	
Weight (Kg)		87.3 ± 9.01	84.7 ± 8.44	84.7 ± 9.81	0.156
Height (m)		1.64 ± 0.04	1.65 ± 0.04	1.65 ± 0.04	0.330
BMI (Kg/m^2)		32.3 ± 3.66	31.05 ± 3.47	31.1 ± 3.94	0.069
Risk factors					
Smoking		31 (44.29)	29 (41.43%)	43 (61.43%)	**0.037***
Family history		23 (32.86)	26 (37.14%)	26 (37.14%)	0.830
Diabetes mellitus		26 (37.14)	27 (38.57%)	31 (44.29%)	0.659
Hypertension		40 (57.14)	37 (52.86%)	34 (48.57%)	0.597
Hyperlipidemia		20 (28.57)	15 (21.43%)	21 (30%)	0.470
CKD		2 (2.86%)	3 (4.29%)	1 (1.43%)	0.598
IHD		16 (22.86)	18 (25.71%)	15 (21.43%)	0.830
Medication	**Clopidogrel 600 mg**	49 (70%)	45 (64.29%)	46 (65.71%)	0.757
	Ticagrelor 90 mg	21 (30%)	25 (35.71%)	24 (34.29%)	
Diagnosis (STEMI territory)					
Anterior		40 (57.1%)	33 (47.14%)	32 (45.71%)	0.605
Inferior		22 (31.4%)	22 (31.43%)	24 (34.29%)	
Posterior		6 (8.6%)	8 (11.43%)	9 (12.86%)	
Lateral		2 (2.9%)	7 (10.00%)	5 (7.14%)	
Clinical examination of vital signs					
HR (beats/min)		85.1 ± 11.68	84.1 ± 9.05	85.7 ± 10.5	0.664
SBP (mmHg)		137.6 ± 11.22	135.4 ± 10.45	135.3 ± 9.74	0.354
DBP (mmHg)		80 ± 7.42	79.7 ± 7.98	81.4 ± 6.66	0.339
RR (breath/min)		21.3 ± 2.17	20.9 ± 2.45	21.5 ± 2.36	0.250
Temperature (^{o}c)		36.9 ± 0.24	36.9 ± 0.23	36.9 ± 0.22	0.875
RBG (mg/dL)		135.7 ± 59.45	143.7 ± 60.94	139.7 ± 55.08	0.725

BMI: body mass index, IHD: ischemic heart disease, STEMI: ST-segment elevated myocardial infarction, HR: heart rate, SBP: systolic blood pressure, DBP: diastolic blood pressure, RR: respiratory rate, RBG: random blood glucose, *: statistically significant as p value <0.05, P1: p value between groups 1 & 2, P2: p value between groups 1 & 3, P3: p value between groups 2 & 3.

Table 2: Angiographic findings, and electrocardiography of the studied groups

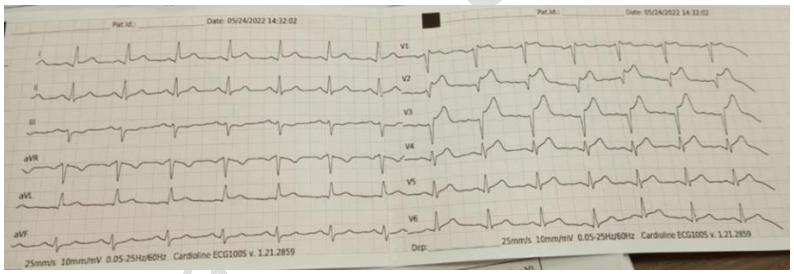
		Group 1 (n=70)	Group 2 (n=70)	Group 3 (n=70)	P value
Initial CTFC (frames)		30.5 ± 3.54	30.6 ± 3.63	30.4 ± 3.48	0.946
CTFC (frames)		18.1 ± 5.03	15.5 ± 5.21	16.8 ± 4.44	**0.009***
		P1=0.003*, P2=0.115, P3= 0.110			
Initial TIMI flow	**0**	26 (37.14%)	33 (47.14%)	37 (52.86%)	0.163
	1	42 (60%)	31 (44.29%)	29 (41.43%)	
	2	2 (2.86%)	6 (8.57%)	3 (4.29%)	
	3	0 (0%)	0 (0%)	1 (1.43%)	
TIMI flow after PCI	**0**	1 (1.43%)	0 (0%)	0 (0%)	**0.002***
	1	2 (2.86%)	0 (0%)	0 (0%)	
	2	24 (34.29%)	14 (20%)	6 (8.57%)	
	3	43 (61.43%)	56 (80%)	64 (91.43%)	
P value between groups		P1=0.062, **P2<0.001*,** P3= 0.053			
Initial MBG	**0-1**	37 (52.86%)	28 (40%)	28 (40%)	0.209
	2-3	33 (47.14%)	42 (60%)	42 (60%)	
MBG after PCI	**0-1**	17 (24.29%)	4 (5.71%)	5 (7.14%)	**0.001***
	2-3	53 (75.71%)	66 (94.29%)	65 (92.86%)	
P value between groups		**P1=0.008***, **P2=0.018*,** P3= 0.989			
Culprit vessel	**LAD**	44 (62.86%)	40 (57.14%)	39 (55.71%)	0.137
	RCA	7 (10%)	18 (25.71%)	16 (22.86%)	
	LCX	19 (27.14%)	12 (17.14%)	15 (21.43%)	
Electrocardiography					
Pre- QRS duration (ms)	**Mean± SD**	84.4 ± 10.02	82.4 ± 7.11	83.3 ± 6.75	0.342
Post- QRS duration (ms)	**Mean± SD**	81.3 ± 9.16	78.9 ± 6.27	81.4 ± 6.21	0.069
Change of QRS duration (ms)	**Mean± SD**	-1.1 ± 9.71	3.6 ± 5.12	1.9 ± 4.27	0.302
	Median (IQR)	0 (0 -10)	0 (0 -10)	0 (0 -10)	
STR	**Mean± SD**	72.7 ± 8.83	85.9 ± 4.96	84.9 ± 7.56	**<0.001***
	Post hoc	**P1<0.001*, P2<0.001*,** P3= 0.357			

CTFC: corrected TIMI frame count, TIMI: thrombolysis in myocardial infarction, MBG: myocardial blush grade, LAD: left anterior descending artery, LCX: left circumflex artery; RCA: right coronary artery, STR: ST-segment resolution, IQR: interquartile range, *: statistically significant as p value <0.05, P1: p value between groups 1 & 2, P: p value between groups 1 & 3, P3: p value between groups 2 & 3.

Table 3: Multivariate logistic regression analysis for prediction of reduction in CTFC and MBG

	in CTFC			in MBG		
	Odds ratio	**95% CI**	**P value**	**Odds ratio**	**95% CI**	**P value**
Age (years)	0.9883	0.9399 to 1.0391	0.645	1.025	0.9840 to 1.0675	0.237
BMI (Kg/m^2)	1.0332	0.9074 to 1.1763	0.622	0.941	0.8458 to 1.0464	0.261
Smoking	3.0820	0.6108 to 15.5510	0.172	1.433	0.3875 to 5.2976	0.590
Family history	1.3015	0.2464 to 6.8736	0.756	2.903	0.6756 to 12.4737	0.152
Diabetes mellitus	2.5911	0.6613 to 10.1533	0.171	0.120	0.0270 to 0.5280	**0.005***
Hypertension	0.1118	0.0203 to 0.6162	**0.012***	1.812	0.3652 to 8.9856	0.467
Hyperlipidemia	0.4834	0.1105 to 2.1144	0.334	1.265	0.2726 to 5.8690	0.764
IHD	0.3303	0.0582 to 1.8745	0.211	0.826	0.1810 to 3.7680	0.805
Atorvastatin/ Rosuvastatin	2.4868	1.0158 to 6.0883	**<0.001***	2.2872	1.0995 to 4.7579	**0.027***

BMI: body mass index, IHD: ischemic heart disease, CI: confidence interval, *: statistically significant as p value <0.05.



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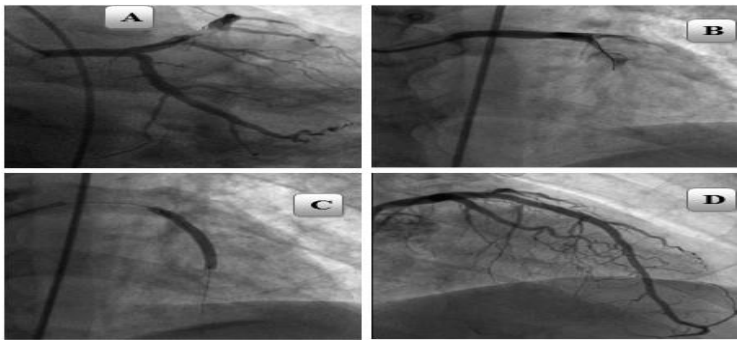

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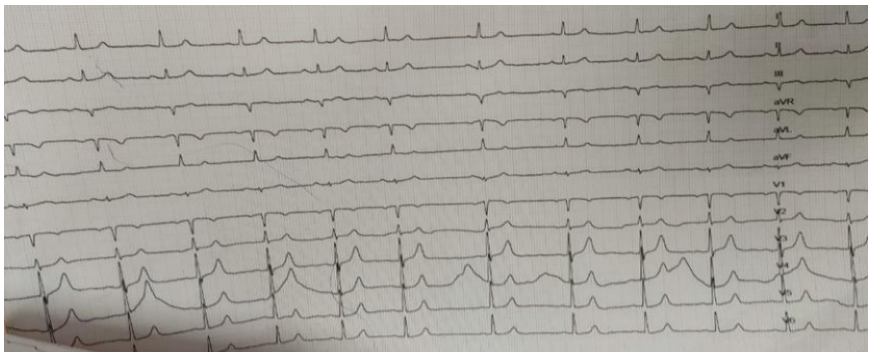

C

Figure 1: A: Surface 12 lead ECG showing NSR and ST segment Elevation in leads V1-5, I, aVL (Anterior STEMI), B: PPCI to LAD in Anterior STEMI patient with direct stenting by 1 DES, A: Coronary angiography revealed proximal segment LAD subtotal thrombotic lesion accompanied by ostial diagonal tight lesion, and very slow distal flow in LAD. B: PTCA wire is passing and measuring the length of the lesion in LAD. C: Inflated DES over the wire after deployment at the site of the lesion in LAD. D: Final result with TIMI III flow, C: Surface 12 lead ECG was done after revascularization and showing complete STR and normal QRS duration

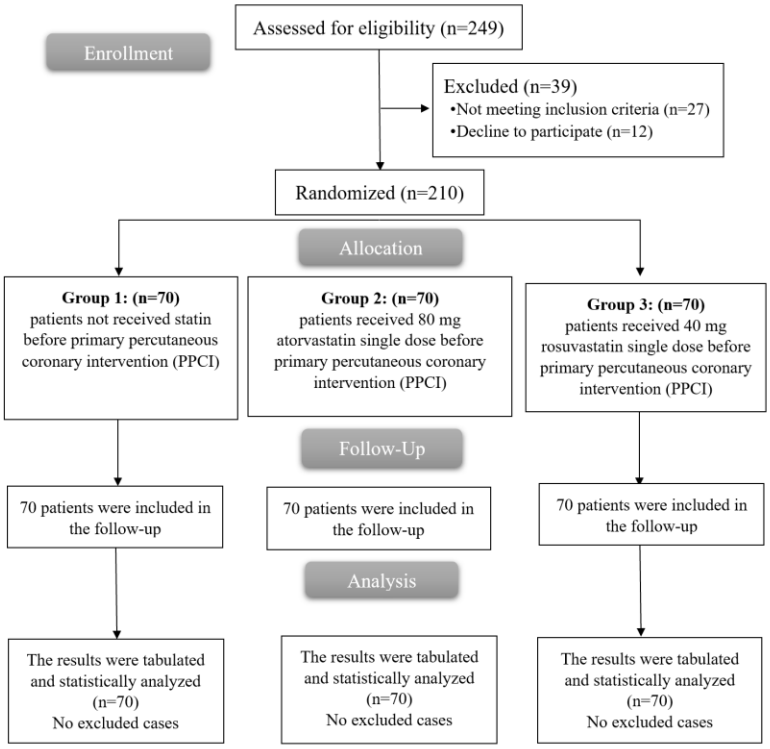

Figure 2: CONSORT flowchart of the enrolled patients

Discussion

Primary percutaneous coronary intervention (pPCI) is the treatment of choice for patients presenting with ST-elevation myocardial infarction (STEMI). Timely pPCI can reduce infarct size and ventricular dysfunction, thus resulting in better clinical outcomes. In patients with stable angina or in those presenting with non-ST-elevation acute coronary syndromes, statin pre-treatment reduces myocardial injury and improves prognosis, also thanks to their pleiotropic properties (16).

In the present study, it was found that age, sex, weight, height, and BMI were insignificantly different among the studied groups.

These results was in agreement with (16)**,** a prospective, double-blind, randomized controlled clinical trial that was conducted on 264 patients with ST-segment elevation myocardial infarction (STEMI) who underwent underwent primary percutaneous coronary intervention (PPCI) to assess the impact of maintenance dose of eptifibatide in them, in which there was no significant difference in terms of gender and age between the group 1 ($n = 147$)who received a maintenance dose of intravenous Eptifibatide (infusion of 2 μg/kg/min) and group 2 ($n = 117$) who did not receive this treatment. Among the patients participating in the study, 147 people were in the intervention group, 95 of them were men (64.6%) and 52 were women (35.4%), and their average age was 59.85. Also, out of 117 patients participating in the control group, 65 were men (55.6%) and 52 were women (44.4%), whose average age was 61.78.

In addition**,** (17) conducted a randomized clinical trial where 668 statin-naive patients were randomly assigned to atorvastatin 80 mg (ator-vastatin group; n =338) or no statin treatment (control group; n=330). The results showed that there were no statistical differences between both groups regarding age, gender, and BMI ($p<0.005$).

In the present study, it was found that smoking was significantly different among the studied groups (P=0.037), being higher in group 3 compared to other groups. The other risk factors including family history, diabetes mellitus, hypertension, hyperlipidemia, CKD and IHD, were insignificantly different among the studied groups regarding.

In agreement with our results, (15) highlighted that there were no statistical differences between the 2 groups regarding smoking (65.9% in the control group and 74.1% in the cases group), hypertension (25.9% in both groups), history of ischemic heart disease (14.1% in the control group and 11.8% in the cases group), and diabetes (21.2% in the control group and 17.6% in the cases group).

In contest with our results, Yuan, et al (18) highlighted that there was no significant difference in terms of family history of coronary artery disease, diabetes mellitus, hypertension, and smoking between the group of rosuvastatin loading before PCI (the loading dose group, n=59) and the no rosuvastatin treatment group before PCI (control group, n=58).

In the present study, it was found that there was insignificant difference among both groups regarding diagnosis (STEMI territory).

This was in agreement with (16) who highlighted that out of the total of 147 patients studied in the intervention group, the location of myocardial infarction in 56.5% of cases was in the anterior regions, 39.3% in the lower regions and in 4.6% in the lateral regions. In the control group, the location of myocardial infarction in 45.3% of cases was in the anterior regions, in 52.1% in the lower regions and in 2.6% in the lateral regions, and in this sense, no significant difference was observed between the two studied groups.

This was in disagreement with (15) who showed that in the control group, 61 patients presented with anterior STEMI (61%) while there were 43 patients (50.6%) in the cases group which was statistically significant with a P value of 0.004. The control group had 16 patients with inferior STEMI (18.8%) vs. 28 patients (32.9%) in the cases group which was statistically significant with a P value of 0.035. There were 8 patients with posterior STEMI (9.4%) in both groups, 6 patients presented with lateral STEMI (7.1%) in only the cases group, and none in the control group with a P value of 0.012 which denotes statistical significance. Most patients in both groups had the LAD as the culprit vessel (71.8% in the control group and 50.6% in the cases group) with a statistical significance indicated by a P value of 0.004.

In the present study, it was found that there was insignificant difference among both groups regarding medications.

This was in agreement with (19), who showed that there were no significant differences in medication during the index hospitalization, including glycoprotein IIb/IIIa inhibitors, at 1 and at 6 months between the atorvastatin group (80 mg before PCI and for 5 days after PCI [n = 89]) and the control group (10 mg daily after PCI [n = 84]).

In the present study, it was found that TIMI flow after PCI was significantly better in group 3 compared to group 1 ($P<0.001$), was better in group 2 compared to group 1 but with no significant difference between both groups. TIMI flow after PCI was insignificantly different between groups 2&3. MBG after PCI was significantly higher in groups 2&3 compared to group 1 ($P=0.008$, 0.018), with no significant difference between groups 2&3.

In agreement with our results, (15) found that in the control group, there were 4 patients with TIMI I flow and MBG I, 13 with TIMI II flow and MBG II, and 68 with TIMI III flow and MBG III. Meanwhile, in the cases group, there was 1 patient with TIMI I flow and MBG I, 3 with TIMI II flow and MBG II, and 81 with TIMI III flow and MBG III. This difference was statistically significant with a P value of 0.010.

These results were indistinguishable with (20), which studied 171 patients with STEMI and randomized to either 80-mg atorvastatin (n = 86) or 10-mg atorvastatin (n = 85) arms for pre-PCI treatment. MBG after primary PCI was higher in the 80-mg atorvastatin arm (MBG, 2.2 ± 0.8 vs. 1.9 ± 0.8, $P = 0.02$); the post-procedural TIMI III flow grade was higher in the 80-mg atorvastatin arm, 83, vs. the 10-mg atorvastatin arm, 76, but it was not statistically significant

with a P value of 0.07. They also found that the corrected TIMI frame count (cTFC) was lower in the 80-mg atorvastatin arm (26.9 ± 12.3 vs. 34.1 ± 19.0, P = 0.01) which was not measured in our study.

In disagreement with our results, (17), a NAPLES-II trial where 668 patients who were not on statin therapy were randomized to an atorvastatin 80 mg (atorvastatin group; n = 338) or no statin (control group; n = 330) the day before elective PCI, and results showed no significant difference in post-procedural TIMI flow grade (P value 0.68). This could be explained by the fact that in the NAPLES-II trial, the patients were undergoing elective PCI, so they do not have an acute thrombotic occlusion thus having a lower risk of no-reflow.

In the present study, it was found that mean STR after PCI was significantly higher in groups 2 and 3 compared to groups 1 (P<0.001, 0.010), and was insignificantly different between groups 2&3.

In agreement with our results (15) in which there were 34 patients in the cases group who showed complete ST-segment resolution (40%) vs. 19 patients (22.4%) in the control group which was statistically significant with a *P* value of 0.013.

This was like the results in (20), the STATIN-STEMI trial where complete STR was significantly better in the 80-mg atorvastatin arm (34 patients [39.5%] vs. 19 patients [23.8%]; *P* = 0.03).

Limitations: Small sample size, short follow-up period and “single center” randomized clinical trial were some of the limitations of the study. There are many factors that affect the outcome of PPCI as duration of myocardial ischemia, door to balloon, thrombus burden, number of stents used, complication of the procedure wasn’t collected.

Conclusion

Administering Atorvastatin 80mg or Rosuvastatin 40mg before primary PCI in acute MI patients significantly improved angiographic outcomes (CTFC, TIMI flow grade, and MBG) and electrocardiographic outcomes (ST-segment resolution) compared to no statin therapy. Both statins showed superior myocardial reperfusion and perfusion, with no significant differences between them. These findings underscore the benefit of high-dose statin administration before PCI in enhancing clinical outcomes in acute MI management.

Future studies should investigate the long-term clinical outcomes of pre-PCI statin administration and explore if there are any specific patient subgroups that may benefit more from one statin over the other.

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