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Effect of Complete Revascularization vs. Staged PCI of Secondary Lesion on LV Systolic Function in Patient with STEMI

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Abstract: After a myocardial infarction, early restoration of normal coronary perfusion reduces infract size, preserves left ventricular function, and lowers mortality. Reperfusion therapy's major goal is to not only restore the culprit epicardial vessel's patency, but also to reperfuse tissue to preserve myocyte viability and hence LV function. The pathophysiology of myocardial infarction, on the other hand, is not limited to the culprit vessel. The treatment of non-culprit lesions in STEMI is a contentious issue. Previously published guidelines (the 2011 PCI and 2013 STEMI guidelines) recommended treating the culprit lesion only if the patient was in cardiogenic shock. These guidelines are based on expert opinions rather than randomized controlled trials, which take into account safety concerns such as complications from repeated intervention, a low technical success rate, a high incidence of coronary restenosis, and renal insufficiency after contrast agent use. The aim of this work is to Long-term outcomes Lt ventricular ejection fraction (6 months) between complete revascularization and culprit-only revascularization (followed by staged percutaneous coronary intervention of secondary lesions) in STEMI patients with multi vessel coronary disease undergoing primary angioplasty. This prospective analysis included 50 patients with acute ST elevation myocardial infarction who were amenable to primary coronary intervention and were admitted to the critical care unit. And was blindly randomized alternatively into 2 groups: Group A: Complete coronary revascularisation during primary percutaneous intervention. Group B: Culprit-only revascularization during primary PCI. This study enrolled 50 patients, 35 males (70%) and 15 females (30%); in G I, there were 18 males (72%) and 7 females (18%) while in G II there were 17 males (68%) and 8 females (32%). The age ranged from 34 yrs. to 82 yrs. with mean age: In G I was 61.6 (±8.9) In G II was 62.2 (±12.9) were enrolled in this study, pre-procedural EF% (Mean±St) there was no significant difference between both groups. In G I, patients had a mean EF% 49.9±10.1 Versus 48.0±11.3 seen in G II. (P=0.54) In G I, there was no a significant difference between pre- procedural versus post-procedural mean EF%. (P=0.53) In G II, there was no a significant difference between pre-procedural versus post-procedural mean EF%. (P=0.14) We concluded that There were no significant differences between infarct-related artery revascularization and multivessel revascularization in the rates of 6-month MACE, Also, there were no differences as regard in-hospital mortality, stroke, cardiogenic shock and reinfarction, ejection fraction.

Keywords: ST Segment Elevation Myocardial Infarction, Primary Percutaneous Coronary Intervention, Transthorathic Echocardiography, Ejection Fraction Evaluation

1. Introduction

In developed countries, coronary artery disease (CAD) is a leading cause of death and morbidity. The coronary artery bypass graft (CABG) was the only standard revascularization procedure prior to the development of PCI. Fortunately, when compared to CABG, there is an alternative treatment for CAD: PCI, which is an effective, safe, less debilitating, and less expensive revascularization technique [5].

The PCI had become a more frequently used treatment than CABG for CAD in most western countries as well as in Egypt. Although, the survival rate and functional status are

commonly used, as the outcome measure for evaluating treatment of CAD [6]. *After a myocardial infarction, early restoration of normal coronary perfusion reduces infract size, preserves left ventricular function, and lowers mortality,. Reperfusion therapy's major goal is to not only restore the culprit epicardial vessel's patency, but also to reperfuse tissue in order to maintain myocyte viability and hence LV function.* [1, 7]. However, the pathophy- siological process of myocardial infarction is not limited to the culprit vessel [2].

According to clinical evidence, between 40-65 percent of patients with ST-segment elevation myocardial infarction (STEMI) have angiographic verified multi-vessel disease, which has been linked to a poorer clinical outcome than single-vessel illness. They have a multiple increased risk of heart failure and cardiogenic shock, as well as a two-fold increase in mortality during hospitalisation and long-term follow-up. [8]. After initial intervention, these individuals have a greater risk of acute coronary syndrome and reperfusion. [2]. Guidelines advocate early revascularization of the culprit lesion by primary percutaneous coronary intervention (PCI) for these patients. However, in this situation, the treatment plan for non-tumor lesions is unclear.[9].

The treatment of non-culprit lesions in STEMI is a contentious issue. Previously published guidelines (the 2011 PCI and 2013 STEMI guidelines) recommended treating the culprit lesion only if the patient was in cardiogenic shock. [10, 3]. These recommendations are based on expert opinions rather than randomised controlled trials, which take into account safety concerns such as complications from repeated intervention, a low technical success rate, a high incidence of coronary restenosis, and renal insufficiency after contrast agent use [4].

The previous Class III (Harm) recommendation for multivessel primary PCI in hemodynamically stable patients with STEMI has been upgraded and modified to a Class IIb recommendation in the current guidelines to include consideration of multivessel PCI, either at the time of primary PCI or as a planned, staged procedure [11].

Treating the culprit and non- culprit lesions together during STEMI has the following potential advantages: *1-* acute multivessel PCI eliminates the need for a secondary procedure; *2-* plaque instability may include non-culprit lesions, potentially triggering recurrent ischaemic events *(12)*; 3-complete coronary revascular-isation is associated with improved cardiac function and better long-term prognosis; and 4- acute multivessel PCI may reduce treatment costs by diminishing the need for future hospitalizations and subsequent procedures [13].

In contrast, acute multivessel PCI may contribute to a higher risk of complications for the following reasons: 1. The severity of non- culprit lesions in STEMI is frequently overestimated, resulting in unnecessary intervention of functionally insignificant lesions [14]. 2. Greater radio-contrast is used, which may be poorly tolerated in STEMI, increasing the risk of contrast-induced nephropathy and worse prognosis; and, 3. deferred treatment of non-culprit lesions allows further discussion of treatment options by the heart team based on the angiogram and non- invasive tests [15].

2. Patients and Methods

2.1. Study Area

This prospective study was conducted on 50 patients with acute ST elevation myocardial infarction who was amenable to primary coronary intervention was blindly randomized alternatively into 2 groups:

Group A: Complete coronary revascularization during primary percutaneous intervention.

Group B: Culprit-only revascularization during primary PCI the study was in National Heart Institute in Egypt from May 2019 to November 2020.

Inclusion criteria:

Will Include fifty patients presenting with acute STEMI and MVD fulfilling the following criteria:

1. Acute STEMI defined as
   a) Ongoing chest pain,
   b) ≥1mm ST elevation in ≥2 contiguous leads or new left bundle branch block,
   c) Presentation ≤12 hours from symptom onset.
2. Multi-vessel CAD is defined as

≥70% diameter stenosis of ≥2 epicardial coronary arteries or their major branches.

Exclusion criteria:

a) Patients with cardiogenic shock.
b) Single vessel disease.
c) Left main disease (≥50% diameter stenosis).
d) Previous bypass surgery (CABG).
e) Severe valvular heart disease.
f) Instent restenosis.
g) Any contraindication to primary angioplasty.
h) Previous MI.
i) Previous PCI

The patients included in this study were subjected to the following

a) Full medical history and clinical examination.
b) Standard 12-lead ECG on admission, after PCI and 6 hourly for 24 hrs, then daily and whenever indicated.

Routine laboratory investigations including:

Cardiac catheterization and percutaneous coronary intervention according to the group.

Cardiac catheterization and percutaneous coronary intervention:

a) All patients will receive aspirin, clopidogrel 300mg, statins and heparin infusions. Other drugs e.g. IV nitrogl- ycerin, ACEI, B-blockers, Ca- channel blockers, antiarrhy- thmics, vasopressor and inotropes will given when indicated.
b) Diagnostic cardiac catheteri- zation will performed through femoral approach using seldinger technique and angiographic measurement and determination of coronary flow (TIMI flow) before and after any procedure will done.
c) Our methods will include the following assessments:
i. Angiographic assessment.
ii. PCI data and angiographic complications assessment.
iii. Clinical assessment including major adverse cardiac

events at 1 and 6 months.
iv. Echocardiographic assessment for ejection fraction.

2.2. Angiographic Assessment: by Quantitative Coronary Angiography

Assessment will done:
Before any procedure, and After final interventions.
Parameters assessed:
a) Identification of infarct related artery (IRA).
b) Determination of the percent of stenosis.
c) Assessment of the extent of coronary vessel affection (single, two or multivessel).
d) Determination of TIMI flow grading before and after the procedure.
e) Reference artery diameter (RAD in mm). It refers to the diameter of closest healthy portion to the lesion.
f) Minimal luminal diameter (MLD in mm). It refers to the smallest measurement in mm of lumen diameter at the site of intervention in the target vessel. TIMI flow:

Grade III (complete reperfusion)
a) Anterograde flow into the terminal coronary artery segment through a stenosis is as prompt as anterograde flow into a comparable segment proximal to the stenosis.
b) Contrast material clears as rapidly from the distal segment as from an uninvolved, more proximal segment.

Grade II (partial reperfusion):
a) Contrast material flows through the stenosis to opacity the terminal artery segment.
b) However, contrast enters the terminal segment perceptibly more slowly than more proximal segments. Alternatively, contrast material clears from a segment distal to a stenosis noticeably more slowly than from a comparable segment not preceded by a significant stenosis.

Grade I: (penetration with minimal perfusion)
A small amount of contrast flows through the stenosis but fails to fully opacity the artery beyond.

Grade 0: (no perfusion) No contrast flow through the stenosis.

2.3. PCI Data and Angiographic Complications Assessment

a) Percutaneous coronary intervention:
b) PCI was attempted to all patients according to the group:

*Group A: complete coronary revascularisation during primary percutaneous intervention starting with the culprit vessel followed by the other vessels.

*Group B: culprit-only revascularisation during primary PCI will followed by elective intervention after one month

for the other significant coronary lesions. The second, elective procedure will driven by the angiographic detection of one or more significant lesions in non-IRA vessels without provocative tests for ischaemia.
a) Single or multiple dilatations will done at the lesion site in the IRA.
b) A suitable sized stent will deployed at the lesion site at adequate pressures.
c) Control injections will done after stenting to assess the TIMI flow and possible complications.
d) Direct stenting (without prediltation), will performed at the discretion of the operator.

2.4. Echocardiographic Assessment for Ejection Fraction (EF)

Each patient will examined in the left lateral decubitus position according to the recommendations of the American Society of Echocardiography.
LVEF will calculated by the equation using modified Simpson's method from apical four and/or two chamber view by 2-D study. The physicians performing echocardiographic evaluation will blinded to the treatment assignment and angiographic results.
a) Assessment of EF will done twice, first during hospital stay and the second at 6 months.
b) Both levels of EF will compared in both groups and within the group.

For all above mentioned statistical tests done, the threshold of significance is fixed at 5% level (p-value).

   The results were considered:
a) Significant when the probability of error is less than 5% ($p < 0.05$).
b) Non-significant when the probability of error is more than 5% ($p > 0.05$).
c) Highly significant when the probability of error is less than 0.1% ($p < 0.001$).

The smaller the p-value obtained, the more significant are the results.

3. Results

This prospective study enrolled 50 patients, with diagnosed ST elevation acute coronary syndrome.
The study included 35 males (70%) and 15 females (30%); in G I, there were 18 males (72%) and 7 females (18%) while in G II there were 17 males (68%) and 8 females (32%).
The age ranged from 34 yrs to 82 yrs with mean age: In G I was 61.6 (±8.9) In G II was 62.2 (±12.9) From Table 1, There was no significant difference between both groups as regard to age and sex (P=NS).

Table 1. Demographic Characteristics between two group.

Variable	G I N=25	G II N=25	t-test	P-Value P<0.05
Age (yrs)	Mean±St 61.6±8.9	Mean±St 62.2±12.9	0.19	0.85
Sex			Chi-Squar	
Male	18	17	0.095	0.75

Variable	G I N=25	G II N=25	t-test	P-Value P<0.05
Female	7	8		

Concerning DM, there were 42 patients had DM (84%) and 8 patients were not diabetic (16%).

a) In G I: 20 patients had DM (80%).

b) In G II: 22 patients had DM (88%).

Concerning Hypertension, there were 39 patients had HTN (78%) and 7 were not (22%).

a) In G I: 18 patients were hypertensive (72%).

b) In G II: 21 patients were hypertensive (84%).

Concerning Smoking, there were 15 patients were smoker (30%) and 35 patients were not (70%).

a) In G I: 8 patients were smoking (32%).

b) In G II: 7 patients were smoking (28%).

Concerning Dyslipidemia, there were 18 patients had dyslipidemia (36%) and 32 patients were not (64%).

a) In G I: 9 patient. s were dyslipidemic (36%).

b) In G II: 9 patients were dyslipidemic (36%).

Concerning pre-procedural Renal impairment, there were 10 patients had renal impairment (20%) and 40 patients were not (80%).

a) In G I: 5 patients had renal impairment (20%).

b) In G II: 5 patients had renal impairment (20%).

Concerning Family History, there were 16 patients with positive family history of IHD (32%) and 34 patients were not (68%).

From table 2, it was evident that there was no significant

difference between both group as regarding to clinical characters (Risk Factors and Family history). (P > 0.05)

Table 2. Clinical Parameters between two group.

Variable	G I N=25	G II N=25	Chi-square	P-Value P<0.05
Risk Factors				
DM	19	20	0.12	0.73
HTN	18	21	1.04	0.30
Dyslipidemia	9	9	0.00	1.00
Smoking	8	7	0.09	0.75
Renal Dysfunction	5	5	0.00	1.00
Family H/O	7	9	0.36	0.54

Concerning Medical history as regard to prior MI and PVD incidence it was as the following:

a) Prior MI: there were 12 patients had prior MI (24%); 6 patients in each group.

b) PVD: there were 5 patients had PVD (10%) and 45 patients were not (90%).

In G I: 3 patients had PVD (12%). In G II: 2 patients had PVD (8%).

3.1. Baseline Echocardiographic Data

Different pre-procedural echocardiographic data collected from patients were listed in table 3.

Table 3. Baseline Echocardiographic Data.

Variable	G I N=25	G II N=25	t-test	P-Value P<0.05
EF%	Mean±St 49.9±10.1	Mean±St 48±11.3	0.60	0.54
WMSI	1.57±0.35	1.50±0.40	0.59	0.55
RWMA	20	19	Chi-square 0.11	0.73

*Concerning pre-procedural EF% (Mean±St) there was no significant difference between both groups. In G I, patients had a mean EF% 49.9±10.1 Versus 48.0±11.3 seen in G II. (P=0.54)

*Concerning Wall Motion Score Index (WMSI), there was no significant difference between both groups. In G I, had a mean WMSI 1.57±0.35 versus 1.5±0.40 in G II on a scale of 17. (P=0.55)

*Concerning RWMA, no significant difference between both groups. In G I, 20 patients had RWMA versus 19 patients in G II. (P=0.73)

3.2. Baseline Angiographic Data

Baseline angiographic data collected during conventional angiography were listed in table 4 providing ≥70% stenosis on ≥2 vessels as the following:

Table 4. Baseline angiographic data between two group.

N	Group I	Culprit	Group II	Culprit
1	LAD 80%, RCA60%, LCX50%, Intermedius 50%	Prox. LAD	LAD 90%, LCX (Subtotal)	LCX
2	Tight tandem LAD lesions 90%, RCA 70% (mid)	Prox. LAD	LAD 80%, LCX 80%	Prox. LAD
3	LAD80%, OM1 prox. 80%, PL branch 90%	Mid LAD	LAD 90%, RCA 95%	RCA
4	LCX 70%, LAD70%, RCA70%	RCA	LAD 80%, OM1 80%, RCA 30%	OM1
5	LAD90%, Osteal D1 70%,	Mid LAD	LAD & D1 (subtotal)	D1
6	LAD (prox80%, dist70%), RCA 60%	Mid LAD	LAD 70%, RCA 70%	RCA
7	LCX 90%, Prox. LAD 50%, Osteal RCA 75%	LCX	D1 (Subtotal), RCA 70%	D1
8	LCX90%, Prox. LAD 80%, Osteal RCA 40%	LCX	LAD 90%, OM1 70% + Thrombus, RCA 80%	OM1
9	LAD 95%, LCX 60%, RCA 70%	Mid LAD	LAD90%, LCX (Subtotal)	LCX
10	LAD90%, RCA 70%	Prox. LAD	RCA (subtotal), Ramus 90%	RCA
11	LAD 99%, RCA 70%	Prox. LAD	LAD 70%, LCX 90%	LCX
12	LAD 80%, LCX60%, OM1 80%, RCA instent restenosis 50-60%	Mid LAD	LAD 90%, OM 1 70%	Prox. LAD
13	RCA 95%, LCX80%	RCA	Prox LAD 50%, Mid LAD (Subtotal), OM1 90%	Mid LAD

N	Group I	Culprit	Group II	Culprit
14	LAD 80%, LCX 70%, RCA 50%	Prox. LAD	Bifurcational LAD90%, RCA80% & Non sign. LCX 30%	Prox. LAD
15	LAD 80%, LCX 75%	Prox. LAD	Prox. LAD90%, Prox OM195%, PDA 80%	OM1
16	LCX 80%, RCA 50%, D1 70%	LCX	LCX 95%, RCA 95%, Prox LAD 30%	LCX
17	LAD70%, LCX70%	Prox. LAD	LAD Thrombus+80%, Prox. D1 80%	Prox. LAD
18	Moderate LAD in stent restenosis followed by mid LAD 70%, PDA95%, Prox. D1 50%	RCA	LAD instent restenosis 60- 70%, D1 80%, OM1 99%, OM2 90%	OM1
19	LAD 80%, D1 prox. 70%,	Prox. LAD	LAD prox 80%, RCA prox 90%	RCA
20	RCA 95%, LCX prox 70%, LCX mid 70%	RCA	LAD 40%, OM2 90%, RCA subtotal	RCA
21	LAD 80%, LCX 70%, OM1 50%, RCA70%	Mid LAD	Bifurcational LAD subtotally, Prox. RCA 70%	Mid LAD
22	LAD (subtotal), D1 50%, RCA 70%	Mid LAD	LAD 80%, IM 70%	Prox. LAD
23	LAD80%, D1 50%, IM 70%	Mid LAD	LAD 70%, D1 80%, RCA eccentric unstasle plaque	RCA
24	LAD 80%, LCX 80%	Prox. LAD	LAD 90%, OM2 90%	Prox. LAD
25	LCX90%, Prox. LAD80%, OstealRCA 40%	LCX	LAD 80%, Mid RCA 2 lesions 80 &90%, PLV 70%	Prox. LAD

3.3. Inhospital and Discharge Medications

All patients received medications on admission and continued on medications as regard to antiplatelets±Glycoprotein IIb/IIIa platelet inhibitors (in hospital), statins, beta blockers, ACEI or ARBs providing there was no contraindications. Medications are listed in table 5.

Table 5. Inhospital and discharge medications.

Variable	G I N=25	G II N=25	Chi-Square	P-Value P<0.05
1. ACEI/ARBs	22	25	3.19	0.07
2. Clopidogrel	25	25	0.00	1.00
3. ASA	25	25	0.00	1.00
4. BB	25	25	0.00	1.00
5. Statins	25	25	0.00	1.00
6. GIIb/IIIa inhibitor	15	14	0.08	0.77

*Concerning Medications during hospitalization and on discharge, there was no significant difference between both groups.

3.4. Clinical Outcome

1-Procedural complications: Non of the patients developed serious complications during the procedure. Table 6 shows a comparison of the procedural complications incidence between both groups.

Table 6. Procedural complications incidence.

Variable	G I	G II	Chi-Square	P-Value P<0.05
1. Acute vessel occlusion	1	2	0.35	0.55
2. Dissection	1	0	1.02	0.31
3. Arrhythmia	0	1	1.02	0.31

*Concerning acute vessel occlusion, it occurred in one patient (Case No. 5) in G I versus 2 patients in G II (Cases No. 14&17). All caused by either occlusion a side branch, De novo thrombosis or acute instent thrombosis, which managed with PTCA plus intracoronary tirofiban and nitroglycerin injection, then patients maintained on tirofiban infusion for 24 hours.
*Concerning Dissection, occurred in one patient in G I (Case No. 21) which managed with stenting.
*Concerning Arrhythmia, V. Tachycardia occurred in one patient (Case No. 17) in G II due to acute vessel occlusion and managed with DC shock at 300 Jouls and reverted to sinus rhythm.
(N.B) No cases of perforation, major bleeding, No Reflow or mortality were recorded.

From table 6, it was evident that there were no significant difference between both groups as regard to Acute vessel occlusion, Dissection, and Arrhythmia.

Concerning Renal impairment, there were 6 patients in each group and there was no significant difference between both groups.

In G I, pre-procedurally there were 5 patients with renal impairment (Cases No. 4, 9, 10, 11 & 17) and one of them known to have CRF on regular haemodialysis. Post procedurally, there were 6 patients had renal impairment (Cases No. 4, 9, 10, 11, 17 & 21). Case No. 21 had a transient renal impairment and treated medically.

In G II, pre-procedurally there were 5 patients with renal impairment (Cases No. 3, 4, 5, 21 & 23) and two of them known to have CRF on regular haemodialysis (Cases No. 5 & 21). Post procedurally, there were 6 patients had renal impairment (Cases No. 3, 4, 5, 16, 21 & 23). Case No. 16 had a transient renal impairment and treated medically while case No. 23 developed Acute renal injury on top of chronic renal impairment and sent for CVVH.

We found that there was no significant difference between both groups as regard to the incidence of the immediate post-procedural events or complications as regard to chest pain, MI, renal impairment.

3.5. Success Rate

The procedure was considered successful when the coronary stenotic lesions managed using stents without a residual stenosis (less than 20%), TIMI 3 flow and without procedure related complications.

Table 7. Success rate after each procedure.

Variable	G I	G II	Chi-Square	P-Value P<0.05
% Success	88%	80%	0.60	0.44

*In G I: Considering the above mentioned definition, the procedure was successful in 88% of patients while 3 patients did not fulfill the criteria.
*In G II: It was successful in 80% of patients while 5 patients did not fulfill the criteria of success.
From table 7 we found that the success rate was higher in G I (88%) than in G II (80%) but of no statistical difference. (P=0.44)

3.6. One Six Months Follow up Events

Following the procedure of PCI, all patients discharged on medical treatment with regular follow up over 6 months. All

patients were subjected to clinical re-evaluation for re-hospitalization either due to re-infarction, target or new target revascularization, heart failure or mortality. Echocardiography routinely done for assessment of EF%.

Table 8. *One Year follow up (3-12 months) events.*

Variable	G I N=25	GII N=25	Chi-square	P-Value P<0.05
1. Re-Hospitalisation	13	8	0.05	0.15
2. Target or new target	11	4	4.66	0.03
3. Revascularization				
4. Re-infarction	2	0	2.08	0.14

Concerning Re-hospitalization, there were 13 patients re-hospitalized in G I versus 8 patients in G II.

a) In G I, 13 patients (52%) were rehospitalized with recurrent chest pain.

b) In G II, 8 patients (32%) were rehospitalized, 2 of them admitted with clinical picture of HF, and remaining patients with recurrent chest pain. Concerning target or new target revasculrization, there were 11 patients underwent target or new target vessel revascularization in G I versus 4 patients in G II.

c) In G I, from 13 patients rehospitalized, only 11 (44%) patients underwent

d) PCI or PTCA.

e) In G II, from 8 patients rehospitalized paients only 4 (16%) underwent

PCI or PTCA and 2 patients underwent coronary angiography (Case No. 4 which showed non significant mid RCA lesion by FFR and Case No. 11 which showed patent stents).

*Concering Re-infarction, there were 2 (8%) patients during follow up in

G I versus no patients in G II.

a) In G I, 2 patients had been reinfarcted and rehospitalized then coronary angiography was done for the following cases: - Case No. 1, 1ry PCI done to Proximal RCA lesion while PTCA to LAD instent restenosis. The case complicated with RCA no reflow which managed pharmacologically (using intracoronary tirofiban, verapamil and nitroglycerin) and then maintained on tirofiban infusion for 24 hours.

b) As regard to re-hospitalization, there was higher incidence rate of re-hospitalization in G I versus G II but no significant difference between both groups (P=0.13).

c) As regard to re-infarction, there was higher incidence of re-infarction in G I versus G II but no significant difference between both groups (P=0.14).

d) As regard to target or new target vessel revascularization, there was higher incidence of target or new target vessel revascularization 11 patients in G I versus 4 patients in G II and there was significant difference between both groups (P=0.03).

e) As regard to mortality, there was no recorded cases of mortality in both groups through the one year follow up.

3.7. Follow up Echocardiography

Echocardiographic study was done for all patients of studied groups during post discharge follow up for assessment mean EF% and was listed in Table 9 and Table 10.

Table 9. *Follow up Echocardiography EF%.*

Variable	G I N=25	G II N=25	t-test	P-Value P<0.05
EF%	Mean±St 50.3±10.7	Mean±St 51.6±11.6	-0.43	0.66

From Table 9, it was evident that, there was no significant difference between both groups as regard to follow up EF% (P=0.66). Further statistical analysis between pre-procedural EF% and Post-discharge EF% in each group separately and listed in table 10.

Table 10. *Comparison between pre-procedural EF% and Post-discharge EF% in each group.*

GROUP	Pre-Proceural EF% Mean±St	Post-Procedural EF% Mean±St	t-test	P-Value P<0.05
G I	49.5±10.1	50.3±10.7	0.62	0.53
G II	48.1±11.3	51.6±11.6	1.08	0.14

From table 10 the following was concluded:

a) In G I, there was no a significant difference between pre-procedural versus post-procedural mean EF%.(P=0.53)

b) In G II, there was no a significant difference between pre-procedural versus post-procedural mean EF%.(P=0.14)

4. Discussion

According to American and European guidelines *2012*, for percutaneous coronary intervention (PCI) in patients with acute coronary syndromes with ST- segment elevation and multivessel disease, primary angioplasty should only be directed to the infarct- related artery (culprit vessel), with decision about PCI of non-culprit lesions guided by objective evidence of residual ischemia at later follow-up. PCI should not be performed in a non-infarct-related artery at the time of primary angioplasty in patients without hemodynamic impairment.

In response to these reports, the 2014 ESC/ EACTS guidelines on myocardial revascularization and the 2015 ACC/ AHA/SCAI.

Focused update on primary PCI committee assigned a new Class IIb recommendation, concluding that MV primary PCI may be considered in selected hemodynamically stable patients with significant non infarct artery stenosis [11].

In patients with acute coronary syndromes without ST-segment elevation the decision to perform either culprit vessel or complete revascularization can be made on individual basis; in patients with favorable anatomy, the competent practitioner can perform either single or multi-

vessel PCI with a high likelihood of success and low risk of morbidity and mortality. The endothelial dysfunction induced by coronary angioplasty, the occurrence of post-procedural infarction and contrast-induced nephropathy, the X-ray exposure, the problem of the informed consent, the procedural costs are aspects that strongly support a strategy based on staged revascularization when appropriate.

Qarawani et al. [16] compared clinical outcomes between multi-vessel revascularization and culprit-only revascularization in One hundred and twenty consecutive patients presented with acute ST elevation myocardial infarction (STEMI) and multivessel coronary stenosis. Ninety five underwent complete revascularization (CR): the culprit artery was opened first followed by dilatation of the other significantly narrowed arteries. Twenty five had culprit only revascularization (COR): the culprit artery only was dilated and the other arteries were left untreated during the primary PCI. Results: Complete revascularization (CR) was associated with reduced incidence of major cardiac events (recurrent ischemia, reinfarction, acute heart failure and in-hospital mortality 16.7 versus 52%, P=0.0001). There was a significant lower rate of recurrent ischemic episodes (4.2% versus 32%, P=0.002), myocardial reinfarction (3.1% versus 16%, P=0.01), reintervention (7.3% versus 32%, P=0.001), acute heart failure (9.4% versus 32%, P=0.01) during the indexed hospitalization and shorter hospitalization (4.4+/-1.27 versus 9.6+/-2.3, P=0.001) in the CR Group. Transient renal dysfunction was more common in CR patients (8.4% versus 4% P=0.01). In-hospital and one year mortality were similar between the two groups.

Multivessel PCI during acute myocardial infarction is feasible and safe. Complete revascularization resulted in an improved acute clinical course. These data support a policy of complete revascularization during primary PCI for STEMI.

In the present study, percutaneous coronary intervention (using drug eluting or bare metal stents) was applied in 50 patients with multi- vessel coronary artery disease (≥ 2 vessels with $\geq 70\%$ stenosis), 25 patients underwent stenting of culprit lesion only (G I) while 25 patients underwent complete percutaneous revascularization stenting (G II). The incidence of procedural or peri-procedural complications or events were recorded, and there was a higher incidence of acute vessel occlusion either due to acute instent thrombosis or occlusion of side branch in G II rather than G I but no significant difference between both groups (P>0.05). As regard to other procedural complications (Dissection and arrhythmia), there was no significant difference between both groups and there was no recorded cases of procedural death, vessel perforation or major bleeding.

In the present study, the immediate post-procedural complications or events showed a higher incidence of immediate post-procedural infarction in G II (2 Cases) versus G I (1 Case) but no significant difference between both groups (P>0.05). As regard to post procedural contrast induced nephropathy, there was one new patient in each group developed transient renal impairment.

In the present study, all patients followed up within 6 monhs and it showed that there was a high incidence of re-hospitalisation 13 patients in G I versus 8 patients in G II but of no significant difference (P=0.13).

Previous studies have represented a variety of conclusions: Previous studies have represented a variety of conclusions: some reported immediate MVR with primary percutaneous intervention was not beneficial and led to worse outcomes. [17]. Some reported that both strategies are similar in clinical outcomes [18].

Other difference "Hamza et al. [19] found no statistically significant difference between CR and COR as regard Hypertension and hyperlipidemia; (26% vs 36%, p=0.36) and (48% vs 42%, p=0.65) respectively but both groups were diabetics because of the study design.

We reported no significant difference between preventive PCI and culprit artery PCI as regarding rates of previous MI (14.3% vs11.8%, p=0.984) that was agreed with [17, 20]. Reported that the percentage distribution of anterior wall MI was 19.2% vs 19.4% p=0.78 and Killip class II-III=6.5% vs 9%, p=0.51 between complete revascularization group and infarct artery only PCI respectively Gershlick et al.[21]. Who reported higher rate of contrast dye use in the complete revascularization, (190–330ml vs 150–250 ml, p<0.0001), Chung et al. [17]. Defined procedural success as Thrombolysis in Myocardial Infarction (TIMI) flow grade III with final stenosis less than 20% without death, recurrent MI, or emergent CABG. Zhang et al. [22]. Reported that MV-PCI was associated with an increased short-term mortality. In-hospital or 30-day death occurred in 4.83% who underwent culprit PCI versus 6.93% who received MV-PCI (OR: 0.50, 95% CI: 0.32 to 0.77, p=0.002). In addition, MV-PCI may increase the risk of renal dysfunction because of the high dose of contrast agent, the difference between two groups are significant (OR: 0.77, 95% CI: 0.61 to 0.97, p=0.03). Mangion K et al. [23]. Reported no significant difference change at 1 year from baseline, Δ LVEF% was (5.2±11.4) in the the preventive PCI and (6.1±8.99) in culprit artery PCI, p=0.22. The CMR sub-study suggests that the benefit of the preventive PCI strategy in PRAMI may not be mediated by any effects on LV function and remodelling.

In another randomized cardiovascular *MR CvLPRIT* Substudy, [24]. Did not observe any significant differences in LV EF% by CMR between multi-vessel PCI and culprit artery PCI on pre- discharge (45.9±9.9 vs 45.1±9.5, p value=0.60) and at 9 months follow-up (±4 weeks) (49.7±9.4 vs 50.8±8.7, p value=0.42) between the two groups. On the contrary Dahud et al. [25]. Showed improvement function of LV regions supplied by the non-infarct related artery observed following complete revascularization (15% vs 0%, p=0.01) which explained the reduced incidences of heart failure episodes in this patient group. *The CvLPRIT* trial [21]. The sample size was calculated based on an expected MACE rate of 37% for culprit artery primary PCI and 22% for MV PCI at 80% power. MV primary PCI was performed in 97 patients, and staged PCI was performed in 42 patients. The composite primary outcome of all- cause death, reinfarction, heart failure, and ischemia-driven revascularization at 12

months occurred in (10%) with MV PCI compared with (21%) with culprit artery primary PCI (HR: 0.45; 95% CI: 0.24 to 0.84; p ¼ 0.009). There were no statistically significant differences in death, reinfarction, heart failure, or repearevascularization rates, although the trends favored MV PCI.

Recently Kim I *et al.* [26]. compared the optimal timing of PCI for nonculprit vessel in patients with STEMI and MVD and reported that deferred staged PCI after one week index PCI was associated with the highest MACE, as compared to both simultaneous multivessel PCI and early staged PCI <1 week.

Even in meta-analysis, the appropriate management of these patients has always been a topic of debate. El-Hayek *et al.* [27]. In a meta-analysis of RCTs, including 1044 patients, demonstrated beneficial outcomes with a multi-vessel PCI strategy versus culprit vessel-only revascularization with a significant reduction in all-cause mortality, recurrent myocardial infarction and the need for revascularization, without an increased risk of complications (including major bleeding, contrast-induced nephropathy or stroke). In a pairwise and network meta- analysis of RCTs for patients with MVD undergoing P-PCI, Elgendy *et al.* [28]. Found complete revascularization at the index procedure or as a staged procedure during the hospitalize-tion or after discharge was associated with a reduction of MACE due to reduction in urgent revascularization with no difference between these 3 strategies of complete revascularization.

Recently "Iqbal MB *et al.* [29]. Reported that MVI at the time of primary PCI may be considered in selected patients, particularly in the setting of nonculprit LAD disease.

Even now, the 2015 *ACC/ AHA/SCAI* focused update recommendation does not distinguish between MV primary PCI and staged PCI, but rather gives 1 recommendation for MV PCI. [11]. However, this limitation of current evidence that could not be answered because the timing of complete revascularization which was variable in the included trials [30].

Some concluded that multivessel revascularization is more beneficial than IRA revascularization [16]. Even recently, two meta-analyses reported different conclusions. A meta-analysis by "INavarese EP *et al.* [*31*]. That included two RCTs and eight nonrandomized controlled trials not considering staged revascularization showed results that multivessel revascularization reduced re-PCI, but did not reduce death or myocardial infarction. Another meta-analysis by Sethi A, *et al.* [32]. that included two RCTs and nine non-randomized controlled trials reported that there were no significant differences in rates of MACE or long-term mortality between the two strategies, but it excluded all cardiogenic shock patients [33].

These results were disagreement with the studies comparing both groups as:

Politi L *et al.* [34] suggested that the multivessel approach is safe and possibly less expensive than an incomplete approach by reducing the probability of further unplanned procedures and without affecting the length of hospitalization.

Hyun *et al.* [35]. Throughout the follow-up, 134 (14.4%) patients experienced at least one MACE, 102 (14.9%) in the COR group and 32 (13.0%) in the MVR group (p=0.379). After a mean follow-up of 9.0±4.2 months from the date of discharge, 23 (2.4%) patients died, 14 (1.5%) from cardiac causes. Seven patients (five in the COR group and two in the MVR group) experienced reinfarction (MI) (P=0.910) while 107 patients (82 (11.7) in the COR group and 25 (10.1) in the MVR group) underwent Revascularization events (re-PCI or CABG) (P=0.301) (TVR was 21 (3.0%) vs 13 (5.3%), P=0.190, non-TVR was 58 (8.3%) vs 12 (4.9%), P=0.053 and CABG was 3 (0.4%) vs00 (0%), P=0.194).

Lee IM *et al.* [*33*] *The Korea acute myocardial infarction registry (KAMIR) investigators,* found that there was no any significant differences between IRA revascularization and multivessel revascularization in the rates of 12-month MACE (165 patients (14.9%) *vs*81 patients (15.1%), p=0.953). The rates of each component of 12-month cumulative MACE were also similar between both groups, except for target lesion revascularization, which showed higher rate in multivessel group (5.9% *vs*2.4%, p < 0.0001). The rate of stent thrombosis was similar between both groups (0.9% *vs*2.6%, p=0.097). This support the current guidelines that recommend IRA revascularization in haemodynamic stable STEMI patients in thesetting of primary PCI. They also suggested that multivessel revascularization might be equally safe and beneficial compared with IRA revasculariza-tion done by an experienced interventionist and in the case of multiple culprit lesion if suspected.

Recently Wald DS *et al.* [36]. Reported the the preventive angioplasty in acute myocardial infarction (PRAMI) trial, results which showed that in patients with acute STEMI, the use of preventive PCI to treat non- infarct coronary artery stenosis immediately after PCI in infarct artery conferred substantial advantages over not performing these additional procedures. The combined rate of cardiac death nonfatal MI or refractory angina was reduced by 65%, an absolute risk reduction of 14 percentage points over 23 months.

However this was in agreement with other studies as;

Also Hannan EL *et al.* [37]. Analyzed 3,521 STEMI patients as treatment strategy of culprit vessel PCI during the index procedure, staged PCI during the index admission, and staged PCI after the index procedure but within 60 days with propensity matching analysis. The results showed that there were no statistical differences in clinical outcomes between culprit vessel PCI during the index procedure group and staged PCI during the index admission. And patients underwent staged multivessel revascularization after the index procedure but within 60 days showed significantly lower mortality rates at 12 month follow up. That study supports the recent guidelines and suggests staged PCI after the index procedure.

5. Conclusion

There were no significant differences between infarct-related artery revascularization and multivessel

revascularization in the rates of 6-month MACE, Also, there were no differences as regard in-hospital mortality, stroke, cardiogenic shock and reinfarction, ejection fraction.

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