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Primary Angioplasty versus Pharmacoinvasive Strategy in Acute ST-Segment–Elevation Myocardial Infarction

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ABSTRACT

Background: Early reperfusion therapy is necessary for ST-segment elevation myocardial infarction (STEMI), and it can be administered via either a pharmacoinvasive method or primary percutaneous coronary intervention (PPCI). **Objective:** The aim of the present study was to compare in hospital and 6 months follow up outcome when primary PCI is used to treat individuals with acute STEMI in PPCI capable center or transferred for PPCI when presented to non-PPCI capable center or treated by pharmacoinvasive strategy.

Patients and methods: A total of 150 patients with acute STEMI were treated in a row. Each participant was subjected to laboratory investigation, transthoracic echocardiography and coronary angiography (**CAG**) with PCI was done for all patients. Three groups of patients were created, with 50 patients in *Group I* receiving treatment with emergency percutaneous coronary intervention in PPCI capable center. *Group II* included 50 patients were transferred for PPCI when presented to non-PPCI capable center and *Group III* included 50 patients was treated with pharmaco-invasive strategy when PPCI couldn't be done in a timely fashion. **Results:** The left ventricle (LV) and right ventricle (RV) function parameters improved following a 6-month follow-up. Across the 3 study groups, there was a very statistically significant difference in terms of average global longitudinal strain (GLS). All the 3 groups of patients showed improvement of LV systolic performance. As regard RV function parameters, it was improved in comparison with in hospital echo parameters with no significant difference as regard RV fractional area change (FAC) and RV S velocity among studied groups.

Conclusion: Primary PCI is the strategy of choice for reperfusion of acute STEMI.

Keywords: Primary percutaneous coronary intervention, ST elevation myocardial infarction, pharmacoinvasive approach, Comparative study, Zagazig University.

INTRODUCTION

Myocardial infarction with ST-Segment elevation 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)].

A pharmacoinvasive approach (PIs) or primary percutaneous coronary intervention (PPCI) is the two treatment options available for ST-segment elevation myocardial infarction (STEMI). Clinical investigations carried out in high-volume hospitals and with sufficient ischemia durations have revealed a decreased mortality rate in patients who get PPCI. Many variables affect the reperfusion approach selected. When it comes to PPCI, proper medical facilities, the right tools, and logistics are needed in addition to skilled human resources [(2)].

The delay in time until the chosen plan is implemented is another important issue to take into account. In order to increase the likelihood of survival, reperfusion should be carried out within the first 12 hours of the beginning of symptoms. Yet, PPCI is frequently not accomplished in an appropriate time and is linked to higher rates of morbidity and mortality. International registries have described this rise in morbidity and death, indicating worse results in the 5-year follow-up of patients undergoing late PPCI when compared to those undergoing PIs [(3)].

The percentage of STEMI patients in low-to-middle-income nations who have an immediate PPCI reperfusion is low. Hence, PIs is a good alternative to prompt PPCI (within the first 120 minutes after diagnosis) when it cannot be delivered and the better availability and relative ease associated with the administration of a fibrinolytic drug with the PIs [(2)].

The aim of the present study was to compare in hospital and 6 months follow up outcome (right and left ventricles functions as primary outcome, PCI complications, MACE and mortality as secondary outcome) when primary PCI is used to treat individuals with acute STEMI in PPCI capable center or transferred for PPCI when presented to non-PPCI capable center or treated by pharmacoinvasive strategy.

PATIENTS AND METHODS

A total of 150 patients with acute STEMI were treated in a row. The study was conducted at Zagazig University Hospital and National Heart Institute, Egypt in the period from April 2020 to September 2021.

Inclusion criteria:

Patients with a first episode of acute STEMI who experienced myocardial ischemia within 12 hours and had persistent electrocardiographic (ECG) ST elevation or new Left Bundle Branch Block (LBBB) along with the release of myocardial necrosis biomarkers are defined as having new ST elevation at the J point in the electrocardiogram (ECG) at least 2 contiguous leads of ≥2mm (0.2mV) in men or ≥1.5mm (0.15mV) in women in leads V2–V3 and/or ≥1mm (0.1mV) in other contiguous chest leads or other limb leads [(4)].

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Exclusion criteria:

Appearance after 12 hours after the onset of chest pain, historical or electrocardiographic evidence of a prior myocardial infarction, documented LV dysfunction or past symptoms suggestive of cardiac failure, Killips Class III or IV at the time of presentation, failed thrombolytic therapy with rescue PCI cases.

Patients were classified into **3 groups** according to management strategy:

Group I included 50 patients received urgent percutaneous coronary intervention in PPCI capable center .

Group II included 50 patients were transferred for PPCI when presented to non-PPCI capable center.

Group III included 50 patients were treated with pharmaco-invasive approach used when PPCI could not be completed quickly.

All patients underwent review of medical history, physical examination and 12 Lead ECG for diagnosis of STEMI with recognition of site of MI. Laboratory investigations including Cardiac enzymes (peak HS troponin), renal function tests (creatinine, GFR at admission, pre PCI and within 72h post PCI), CBC (WBC, HB, and platelet count), Lipid profile (LDL, TG) and Hb A1C.

Transthoracic Echocardiography used General Electric System Vivid-3machine with (2.5-5) MHZ probe. LVEDV, LVESV, LVEF, E/e' ratio, LA size, LV myocardial performance index, LV GLS, RV FAC, TAPSE, RV S' and PAP were measured.

Coronary angiography (**CAG**) with PCI was done for all patients and data collected were (culprit lesion, number of diseased vessels, number of stents, TIMI flow pre and post PCI, MBG and use of GP IIb IIIa inhibitors).

We followed all patients' in-hospital and 6 months after discharge as regard PCI complications (flow limiting dissection, CIN and no reflow), MACE (bleeding, reinfarction, recurrent UA, clinical HF, arrhythmia, cardiogenic shock and stroke) and death.

Ethics Approval:

This study was ethically approved by the Institutional Review Board of the Faculty of Medicine, Zagazig University. Written informed consent was obtained from all participants. This study was executed according to the code of ethics of the World Medical Association (Declaration of Helsinki) for studies on humans.

Statistical Analysis

The collected data were introduced and statistically analyzed by utilizing the Statistical Package for Social Sciences (SPSS) version 20 for windows. Qualitative data were defined as numbers and percentages. Chi-Square test and Fisher's exact test were used for comparison between categorical variables as appropriate. Quantitative data were tested for normality by Kolmogorov-Smirnov test. Normal distribution of variables was described as mean and standard deviation, and non-parametric data as median and range.

A one-way analysis of variance was utilized to compare numerical variables between more than two groups; ANOVA (F) test with post hoc multiple 3-group comparisons in normally distributed, and non-parametric data with Kruskal Wallis test with post hoc multiple 3-group comparisons. P value ≤ 0.05 was considered to be statistically significant.

RESULTS

Table 1 shows that there were insignificant differences among studied groups as regard age, BMI, HR, SBP and DBP. Male gender showed predominance in all groups but with statistical insignificant difference. Regarding risk factors, there were insignificant differences among studied groups regarding DM, HTN, FH, DLP, smoking. More than half of patients in 3 groups had KILLIP Class I with statistical insignificant difference**.**

Table (1): Basic characteristics and risk factors of the studied groups.

Variable	Group 1 N=50		Group 2 N=50		Group 3 N=50		*f*-test	P-value
Age (years) • ***Mean ± SD*** • ***Range***	58.8 ± 9 44-80		61.2 ± 8.1 43-82		60.1 ± 9.6 38-80		0.892	0.412
BMI (kg/m2) • ***Mean ± SD*** • ***Range***	27.6 ± 4.27 20.06-35.09		28.12 ± 3.68 21.35-36		26.53 ± 3.65 20.58-36		2.33	0.1
HR (bpm) • ***Mean ± SD*** • ***Range***	79.35 ± 15.3 45-115		85.49 ± 19.43 43-125		86.29 ± 20.09 45-130		2.04	0.134
SBP(mmHg) • ***Mean ± SD*** • ***Range***	127.5 ± 11.25 105-150		125 ± 15 (95-155)		130 ± 15 (100-160)		1.626	0.200
DBP(mmHg) • ***Mean ± SD*** • ***Range***	80 ± 7.5 65-95		85 ± 7.5 (70-100)		75 ± 7.5 (60-90)		0.042	0.94
Variable	**N**	**%**	**N**	**%**	**N**	**%**	**χ 2**	**P-value**
Sex: • ***Male*** • ***Female***	35 15	75 25	33 17	66 34	38 12	76 24	1.7	0.432
Risk factors: • ***DM***	33	66	13	26	20	40	2.9	0.239
• ***HTN***	18	36	26	52	22	44	3.1	0.217
• ***FH***	13	26	11	22	17	34	0.287	0.866
• ***Smoking***	30	60	21	42	26	52	1.3	0.513
• ***Dyslipidemia***	29	58	30	60	26	52	1.1	0.567
KILLIP Class: • **I** • **II**	37 13	74 26	35 15	70 30	40 10	80 20	1.3	0.512
Chest pain duration (hours)**:** • ***Mean ± SD*** • ***Range***	3.4 ± 2.2 2-10		5.1 ± 2.2 2-9		3.9 ± 2.1 2-9		3.6	**0.029*** *P1=**0.005*** *P2=0.362* ***P3=0.009***

Data is shown as number (percentage) or mean ± standard deviation. Chi-square (χ 2) and ANOVA (F) tests were used.*Statistically significant as P<0.05. Bold values are statistically significant at P<0.05.
P1: Group1 Vs Group2. P2: Group1 Vs Group3. P3: Group2 Vs Group3.
Abbreviations: SD; standard deviation, IQR; inter quartile range, BMI; body mass index, HR; heart rate, SBP; systolic blood pressure, DBP; diastolic blood pressure, DM; diabetes mellitus, HTN; hypertension, FH; family history.

There was highly statistically significant difference between the three studied groups as regard average GLS. *Group I* had the highest mean of GLS (-15) than other groups with statistical significant difference. All the three groups had high LV dimensions, LVESV, LVEDV and low EF. There was insignificant differences among studied groups as regard LV MPI, RV FAC, RV S VELOCITY, LA dimensions, E/E' (**Table 2**).

Table (2): Transthoracic Echocardiographic parameters among the studied group.

Variable	Group 1 N=50	Group 2 N=50	Group 3 N=50	*f*-test	P-value
LV MPI: • ***Mean ± SD*** • ***Range***	0.68 ± 0.108 0.20 -0.90	0.72 ± 0.108 0.34 -0.99	0.61 ± 0.1 05 0.30 -0.88	1.99	*0.*059 P1=0.052 P2=0.055 P3=0.062
E/e' • **Mean± SD** **Range**	11.49 ± 2.65 6.92-17.44	11.6 ± 4 6.5-24.6	10.46 ± 3.7 5.6-24.6	1.71	0.18 P1=0.15 P2=0.17 P3=0.21
LA size(cm) • ***Mean ± SD*** • ***Range***	3.2 ± 0.59 2.4-4.5	3.3 ± .57 2.4-4.6	3.3 ± 0.60 2.3-4.4	.487	0 .615 *P1=0.332* *P2=0. 529* *P3=0.733*
Average GLS (%) • ***Mean ± SD*** • ***Range***	-15 ± 2.5 (-10 to -20)	-11.5±2.125 (-7.5 to -16)	-13 ± 2.5 (-8 to -18)	11.6	**0.002*** ***P1<0.001*** ***P2=0.022*** ***P3=0.035***
RV FAC (%) • ***Mean ± SD*** • ***Range***	46 ± 7 32-60	40± 5 30-50	43 ± 6 31-55	.97	0.726 P1=0.75 P2=0.73 P3=0.701
TAPSE(cm) • ***Mean ± SD*** • ***Range***	19.2 ± 2.6 14-25	19.4 ± 2.5 15-24	19.3 ± 2.5 16-23	0.066	0.937 *P1=0. 723* *P2=0.813* *P3=0.903*
RV S velocity(cm/s) • ***Mean ± SD*** • ***Range***	11 ± 2 7-15	9.75 ± 1.875 6-13.5	10.25 ± 1.875 6.5-14	1.09	0.625 P1=0.59 P2=0.611 P3=0.633
SPAP(mmHG) • ***Mean ± SD*** • ***Range***	30 ± 8.2 17-45	29.6 ± 7.8 20-43	25.4 ± 7.6 18-40	0.472	0.955 *P1=0.792* *P2=0.792* *P3=1*
LVESV (ml) • ***Mean ± SD*** • ***Range***	52.75 ± 11.125 30.5-75	60 ± 10 40-80	57.5 ± 11.25 35-80	0.99	0.078 P1=0.07 P2=0.075 P3=0.081
LVEDV (ml) • ***Mean ± SD*** • ***Range***	96 ± 13 70-122	99 ± 10.4 78-120	96 ± 13.25 70-123	1.09	0.06 P1=0.055 P2=0.063 P3=0.059
EF (%) • ***Mean ± SD*** • ***Range***	47.25 ± 4.375 38.5-56	40.95 ± 3.775 33.4-48.5	42.5 ± 3.75 35-50	0.91	0.083 P1=0.080 P2=0.085 P3=0.088

Data is shown as number (percentage) or mean ± standard deviation. ANOVA (F) test was used.*Statistically significant as P<0.05. Bold values are statistically significant at P<0.05.
P1: Group1 Vs Group2. P2: Group1 Vs Group3. P3: Group2 Vs Group3.

Abbreviations: SD; standard deviation, LV: left ventricular, LA; left atrial, LV MPI; left ventricular myocardial performance index, GLS; global longitudinal strain, EF; ejection fraction, LVESV; left ventricular end systolic volume, LVEDV; left ventricular end diastolic volume, RV FAC; right ventricular fractional area change, TAPSE; tricuspid annular plane systolic, SPAP; systolic pulmonary artery pressure.

As regard angiographic data, most of patients in Groups I and II had TIMI flow pre PCI in grade 0 and 1 in comparison with *Group III* in which most patients were in grade 2 and 3 with significant difference among studied groups**.** While more patients in *Group III* was TIMI flow post PCI grade 3 in comparison with *Group I* and *Group II* with statistical significant differences**.** There was statistically significant difference between the 3 studied groups as regard NO reflow, CIN and Use of GP IIb IIIa inhibitors**.** There were statistically insignificant differences among studied groups as regard culprit lesion, number of diseased vessels, number of stents and flow limiting dissection **(Table 3)**.

Table (3): Angiographic data and procedural outcomes among the studied groups.

	Variable	Group 1 (N=50)		Group 2 (N=50)		Group 3 (N=50)		χ 2	P-value
		N	%	N	%	N	%		
Culprit:	• **LAD**	20	40	21	42	22	44	0.389	0.8232
	• **LCX**	16	32	17	34	15	30		
	• **RCA**	14	28	12	24	13	26		
Number of diseased vessels:	• **1**	30	60	27	54	22	44	1.089	0.721
	• **2**	12	24	16	32	18	36		
	• **3**	8	16	7	14	10	20		
TIMI flow pre PCI	• **0**	33	66	32	64	0	0	11.8	**0.012***
	• **1**	17	34	18	36	4	8		
	• **2**	0	0	0	0	39	78		
	• **3**	0	0	0	0	7	14		
TIMI flow post PCI:	• **0**	0	0	0	0	0	0	15.8	**0.009***
	• **1**	4	8	11	22	3	6		
	• **2**	5	10	4	8	5	10		
	• **3**	41	82	35	70	42	84		
MBG:	• **0**	4	8	11	22	3	6	9.8	**0.023***
	• **1**	1	2	3	6	1	2		
	• **2**	5	10	3	6	4	8		
	• **3**	40	80	33	66	42	84		
Stents:	• ***1***	24	48	22	44	31	62	2	0.727
	• ***2***	16	32	17	34	16	32		
	• **3**	10	20	11	22	3	6		
Flow limiting dissection		1	2	2	4	1	2	0.514	0.773
NO reflow		5	10	14	28	4	8	10.5	**0.010***
CIN		5	10	8	16	4	8	7.8	**0.021***
Use of GP IIb IIIa inhibitors		8	16	18	36	2	4	12.4	**0.008***

Data is shown as number (percentage). Chi-square (χ 2) was used.*Statistically significant as P<0.05. Bold values are statistically significant at P<0.05. Abbreviations: **LAD**; left anterior descending, **LCX**; Left Circumflex, **RCA**; right coronary artery, **MBG**; Myocardial blush grade, **CIN**; contrast-induced nephropathy, **GP**; glycoprotein.

As regard in hospital complications, the incidence of minor bleeding was the highest in *Group III* in comparison with *Group I* and *Group II*, and showed statistically significant difference between the 3 studied groups. There was no significant difference among studied groups as regard major bleeding, recurrent UA, HF, stroke, arrhythmia, reinfarcton, cardiogenic shock and death **(Table 4)**.

Table (4): In hospital Complications among the studied groups.

Variable	Group 1 (N=50)		Group 2 (N=50)		Group 3 (N=50)		χ 2	P-value
	N	%	N	%	N	%		
Major bleeding	2	4	3	6	6	12	2.6	0.279
Minor bleeding	2	4	7	14	10	20	10.5	**0.021***
Arrhythmia	2	4	3	6	2	4	0.3	0. 861
Recurrent UA	2	4	3	6	2	4	0.3	0. 861
Clinical HF	3	6	8	16	4	8	3.1	0.211
Stroke	0	0	1	2	2	4	0.033	0.992
Reinfarction	1	2	1	2	0	0	0.028	0.997
Cardiogenic shock	2	4	4	8	3	6	0.412	0.643
Death	1	2	2	4	1	2	0.514	0.773

Data is shown as number (percentage). Chi-square (χ 2) was used.*Statistically significant as p<0.05. Bold values are statistically significant at P<0.05. Abbreviations: UA; unstable angina, HF; heart failure.

As regard after 6 months follow up, all complications decreased among 3 groups in comparison to in hospital complications and only clinical heart failure was significantly higher among *Group II*. There was no significant difference as regard minor bleeding, recurrent UA, arrhythmia, reinfarction, cardiogenic shock and death.

Follow up after 6 months showed improvement of LV and RV function parameters. There was highly statistically significant difference between the 3 studied groups as regard average GLS. All the 3 groups of patients showed improvement of LV systolic function including decrease of LVESV, LVEDV and increase of LVEF especially in *Group I* with primary PCI with significant difference between all the 3 groups. There was no significant difference between *Group I* and *Group III* regarding LVEDV and LVEF, but there was significant difference as regard LVESV.

Comparison between Group II and Group III showed that there was significant difference between both groups as LVEF, but there was no significant difference as regard LVESV and LVEDV **(Table 5)**.

Table (5): Six months follow up and prognosis of the studied groups.

Variable	Group 1 (N=49)		Group 2 (N=48)		Group 3 (N=49)		χ 2	P-value
	N	%	N	%	N	%		
Minor bleeding	0	0	1	2.08	1	2.04	0.233	0.716
Arrhythmia	1	2.04	2	4.16	2	4.08	0.3	0. 861
Recurrent UA	1	2.04	3	6.24	2	4.08	0.3	0. 861
Clinical HF	2	4.08	6	12.48	3	6.12	3.10	**0.019***
Reinfarction	1	2.04	1	2.08	0	0	0.233	0.716
Cardiogenic shock	1	2.04	2	4.16	1	2.04	0.033	0.992
Death	0	0	1	2.08	0	0	0.028	0.997
Average GLS: • ***Mean ± SD*** • ***Range***	-19 ± 2.5 (-14 to -24)		-13.75 ± 2.125 (-9.5 to -18)		-15 ± 2.5 (-10 to -20)		13.5	**<0.001*** *P1<**0.001*** *P2=0.051* ***P3=0.006***
RV FAC: • ***Mean ± SD*** • ***Range***	53 ± 6.5 40-66		45 ± 5 35-55		49 ± 5.5 38-60		1.87	0.088
RV S velocity: • ***Mean ± SD*** • ***Range***	13 ± 1.5 10-16		10.75 ± 1.625 7.5-14		12 ± 1.5 9-15		1.08	0.231
LVESV (ml) • ***Mean ± SD*** • ***Range***	31 ± 5.5 20-42		54 ± 13 28-80		50.5 ± 12.75 25-76		2.19	**0.045*** ***P1=0.010*** ***P2=0.049*** ***P3=****0.051*
LVEDV (ml) • ***Mean ± SD*** • ***Range***	60 ± 5 50-70		90.5 ± 16.25 58-123		88 ± 16.5 55-122		2.11	**0.047*** *P1=**0.035*** *P2=0.118* ***P3=****0.122*
EF (%) • ***Mean ± SD*** • ***Range***	50 ± 5 40-60		43.5 ± 4.25 35-52		46.5 ± 4.25 38-55		2.52	**0.040*** *P1=**0.018*** *P2=0.052* ***P3=0.044***

Data is shown as number (percentage) or mean ± standard deviation. ANOVA (F) test was used.*statistically significant as P<0.05. Bold values are statistically significant at P<0.05.

P1: Group1 Vs Group2. P2: Group1 Vs Group3. P3: Group2 Vs Group3.

Abbreviations: UA; unstable angina, HF; heart failure, SD; standard deviation, LV: left ventricular, GLS; global longitudinal strain, EF; ejection fraction, LVESV; left ventricular end systolic volume, LVEDV; left ventricular end diastolic volume, RV FAC; right ventricular fractional area change.

We can compare curves for 3 different groups of subjects. We can look for gaps in these curves in a horizontal or vertical direction. A vertical gap means that at a specific time point, 2 groups had a greater fraction of subjects surviving (Groups I and III). However, the Kaplan–Meier survival curve showed non-significant differences in 6 months survival between the 3 groups **(Figure 1)**.

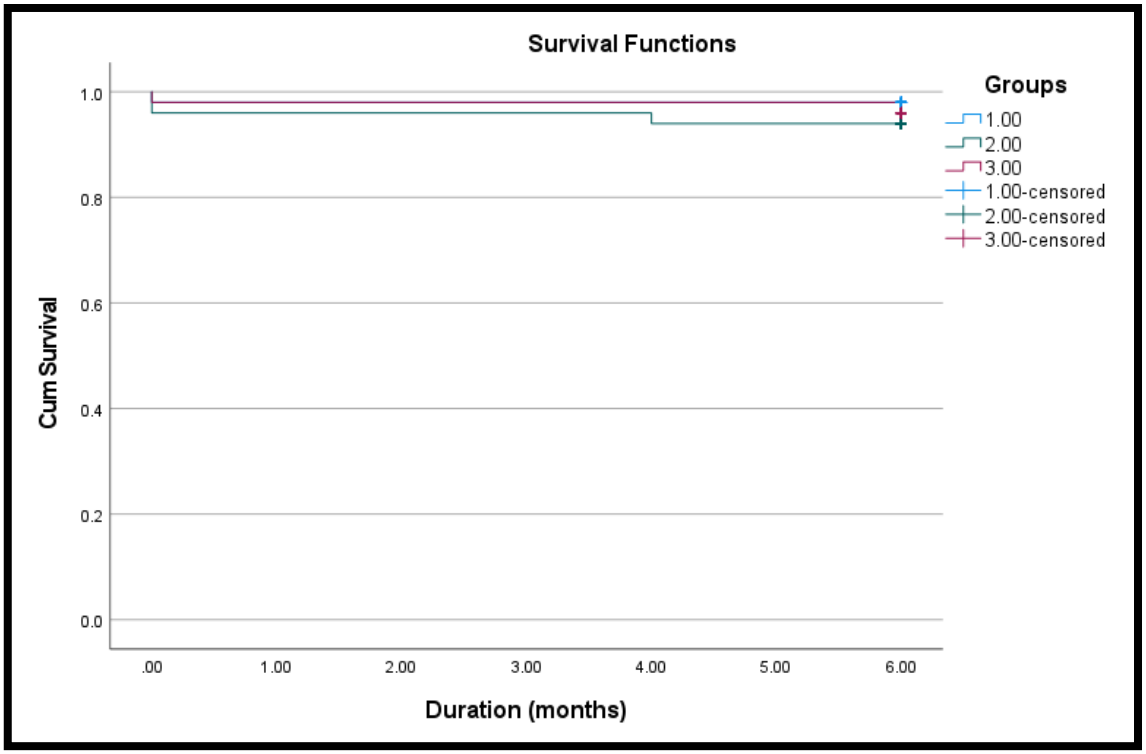

Figure (1): Kaplan Meier for survival time among the study groups.

DISCUSSION

We discovered in our study that there was no statistically significant difference between the 3 analyzed groups in terms of fundamental patient characteristics **(P>0.05).**

This was consistent with **Helal *et al.*** [5] **t**here was no significant difference between patients treated with main PCI, patients transferred for primary PCI, and patients treated with a pharmacoinvasive approach, according to researchers as regard basic characteristics of the studied patients **(P>0.05).**

It was discovered in this investigation that *Group I* had the highest mean of GLS (-15) in comparison to other groups with statistical significant difference **(P=0.002)**. The difference due to group II who had the lowest mean of GLS (-11.5) and showed high significant difference with *Group I* **(P1<0.001)** and significant difference *Group III* **(P3=0.035)**, there were substantial differences between *Group I* and Groups II and III **(P2=0.022)**.

This was similar to **Paul and George** [6] who discovered a substantial difference between individuals treated with primary PCI and those treated with a pharmaco-invasive strategy as regard average GLS which was better in primary PCI group **(P=0.03)**.

It was found that all the 3 groups had low LVEF (47.25±4.375 vs. 40.95±3.775 vs. 42.5±3.75), which was better in *Group I* but with no substantial difference between groups analyzed **(P>0.05).** This was similar to **Sim *et al.*** [7] who no statistically significant differences were detected between individuals treated with primary PCI and those treated with a pharmaco-invasive approach as regard EF **(P=0.709)**.

However, this was discordant with **Paul and George** [6] who discovered a substantial difference between individuals treated with primary PCI and those treated with a pharmaco-invasive strategy as regard EF which was better in Primary PCI group **(P=0.02)**, this was due to primary PCI group had less risk factors and less extent of CAD.

Kawecki *et al.* [8] found that LVEF considerably higher for patients admitted straight for PPCI compared to individuals transferred for PCI (47.5±10.2% vs. 46.3±10.4%, respectively **(P<0.001)**, this was attributed to big number of patients through their study (132715 patients).

In the current study, as regard angiographic data, most of patients in Groups I and II had TIMI FLOW pre PCI in grade 0 and 1 in comparison with *Group III* in which most patients were in grade 2 and 3 with significant difference among studied groups **(P=0.012).** While more patients in group III was TIMI FLOW post PCI grade 3 in comparison with statistically significant differences exist between *Group I* and *Group II* **(P=0.009)**.

Paul and George [6] there was a substantial difference between those treated with primary PCI and those treated with a pharmaco-invasive approach as regard TIMI flow pre angiography **(P=0.001).**

In contrast to **Sierra-Fragoso *et al.*** [9] who indicated there was no significant statistical differences observed between primary PCI patients vs. pharmaco-invasive strategy patients regarding TIMI flow post angiography **(P=0.26)**, this was attributed to they used GP IIb IIIa inhibitors in about 60% of primary PCI patients.

The majority of patients in groups I and III had MBG grade 3 in comparison to *Group II* with statistically significant differences among the 3 groups **(P=0.023)**, this was in concordant to **Helal *et al.*** [5] **t**hey discovered that MBG was significantly higher in

patients treated with pharmaco-invasive method than in individuals treated with primary PCI or transferred for primary PCI **(P=0.001)**.

We found that the incidence of PCI complications including no reflow and CIN were significantly predominant in *Group II* compared to groups I and III, while *Group III* demonstrated the least incidence of these complication **(P values 0.010** and **0.021, respectively).**

Paul and George [6] found that a statistically significant trend towards an elevated incidence of acute renal injury was observed among hospital complications in individuals who received PCI after thrombolysis **(P=0.05)**. This was discordant with our results and that was because the significance in our study mostly came from *Group II* of transferred patients for PCI, which had the highest incidence of CIN, and **Paul and George** did not study this group of patients**.**

Sierra-Fragoso *et al.* [9] found that no statistically significant differences were identified between the primary PCI group vs. pharmaco-invasive strategy group as regard no reflow **(P=0.166).** This was discordant with our results and that was because the significance in our study mostly came from *Group II* of transferred patients for PCI, which had the highest incidence of no reflow, and **Sierra-Fragoso *et al.*** [9] did not study this group of patients**.**

We found that GP IIb IIIa inhibitors were used significantly common in *Group II* with transferred patients for PPCI compared to other groups, also GP IIb IIIa inhibitors were used in more common in primary PCI compared to group pharmaco-invasive group **(P=0.008).** This was similar to previously mentioned studies [7,8]**.**

Sim *et al.* [7] reported that patients who underwent primary PCI were much more likely than other patients to utilize GP IIb IIIa inhibitors patients underwent pharmaco-invasive strategy **(P<0.001)**.

Kawecki *et al.* [8] found that there was highly significant difference as regard Intermittent use of GP IIb IIIa inhibitors group and transfer patients group **(P<0.001)**.

In this investigation, there was no discernible difference among studied groups as regard the quantity of infected vessels **(P=0.721).** This was concordant with previously mentioned studies [6,7]**.**

This was in contrary to **Rathod *et al.*** [10] who between January 2005 and September 2015 conducted an observational cohort analysis of patients with STEMI who received primary PCI at heart attack centers in London, UK. Patients moved to a PCI facility versus patients admitted directly for PPCI were studied, and it was discovered that 3 was a highly significant difference between the 2 groups as regard number of diseased vessels **(P<0.001)** this was attributed by big number of patients included in this study, it was more than 25000 patients.

In the current study, amongst the studied groups, there was a statistically negligible difference in reference to number of stents **(P=0.727)**.

In the current study, as regard in hospital complications, the incidence of minor bleeding was the highest *Group III* demonstrated statistically significant differences between the 3 analyzed groups when compared to groups I and II **(P=0.021)**.

Our findings was discordant with **Paul and George** [6] who found that there was no significant difference between primary PCI group vs. pharmaco-invasive strategy group as regard minor bleeding **(P=1)**, this was attributed with no usage of GP IIb IIIa inhibitors, the majority of patients in the pharmacoinvasive arm underwent effective thrombolysis, leaving little residual thrombus burden in the culprit artery and also small numbers of patients through study of 120 patients.

In the current study, for additional hospital issues, there was no difference between the study groups as regard in-hospital complications and MACE **(P>0.05)**. This was similar to other studies [9-11].

Sierra-Fragoso *et al.* [9] found that the major PCI group did not differ significantly from one another vs. pharmaco-invasive strategy group as regard MACE, major bleeding, stroke, in hospital death and MI **(P>0.05)**.

Rathod *et al.* [10] discovered that there was no discernible difference between primary PCI group versus transferred for PCI group as regard stroke, death and reinfarction **(P>0.05)**.

Chacón-Diaz *et al* [11] was determined that there was no statistically significant difference between the primary PCI group and pharmaco-invasive strategy group as regard all-cause mortality, cardiovascular mortality, cardiogenic shock, post heart failure following myocardial infarction, angina, severe bleeding, and stroke **(P>0.05)**.

However, **Bainey *et al.*** [3] found that cardiogenic shock, CHF and death were significantly common in pharmacoinvasive strategy group compared to primary PCI group **(P<0.001),** however, there was no discernible difference between the 2 groups as regard major bleeding, recurrent MI and stroke **(P>0.05)**. This was attributed by big number of participants in the study, it was 3287 patients.

In the current study, regarding after 6 months follow up, all complications decreased among 3 groups in comparison to in hospital complications and only clinical heart failure was significantly higher among *Group II* **(P=0.019).** For additional follow-up issues and MACE, there was no discernible difference **(P>0.05)**. This was similar to [7,11,12]**.**

Zubaid *et al.* [12] revealed that no differences were found to be significant observed between primary PCI group vs. patients who treated with pharmaco-invasive strategy group regarding 6-month follow-up for mortality, reinfarction, stroke, or CHF **(P=0.79)**.

Chacón-Diaz *et al.* [11] it was discovered that there was no discernible difference between the primary PCI

group and pharmaco-invasive strategy group as regard cardiovascular death and symptomatic heart failure at 30 days follow up **(P=0.0527)**.

All the 3 groups of patients showed improvement of LV systolic function including decrease of LVESV, LVEDV and increase of LVEF especially in *Group I* with primary PCI with significant difference between all the 3 groups.

Significant differences existed between groups I and II regarding LVESDV (31±5.5 vs. 54±13, **P=0.010**), LVEDV (60±5 Vs 90.5±16.25, **P=0.035**) and LVEF (50±5 vs. 43.5±4.25, **P=0.018**).

Group I and *Group III* did not significantly differ from one another regarding LVEDV (60±5 vs. 88±16.5, **P=0.118**) and LVEF (50±5 vs. 46.5±4.25, **P=0.052**) however, 3 was a big difference as regard LVESV (31±5.5 vs. 50.5±12.75, **P=0.049**).

Comparison between Groups II and III demonstrated a substantial disparity between the 2 groups as LVEF (43.5±4.25 vs. 46.5±4.25, **P=0.044**), but there was no significant difference as regard LVESV (54±13 vs. 50.5±12.75, **P=0.051**) and LVEDV (90.5±16.25 vs. 88±16.5, **P=0.112**).

Previous study by **Abdul-Aziz *et al.*** [13] reported that no significant difference between Pharmaco-Invasive Strategy group and primary PCI group regarding LVEDV, LVESV and LVEF at follow up after 3 months (**P values 0.078 and 0.318**, respectively).

CONCLUSION

The preferred method for reperfusion of acute STEMI is primary PCI. For patients presenting with ST elevation myocardial infarction where initial PCI was not possible or couldn't be done in a timely fashion, pharmaco-invasive method with early PCI following fibrinolysis within 24 hours also constitutes a suitable reperfusion strategy as our study showed non inferiority to Primary PCI as regard in-hospital and 6 months post discharge follow up for MACE and mortality, only with increased incidence of minor bleeding. Transferring STEMI patients to PCI-capable institutions shouldn't prevent these patients from receiving early revascularization, and it should be done within maximum 120 minutes otherwise inter hospital delay will affect outcome greatly.

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REFERENCES

1. **Ibanez B**, **James S**, **Agewall S *et al.* (2018):** ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal, 39:119-77.
2. **Araiza-Garaygordobil D, Gopar-Nieto R, Cabello-López A *et al.* (2020):** Pharmacoinvasive strategy vs primary percutaneous coronary intervention in patients with ST- elevation myocardial infarction: results from a study in Mexico City. CJC Open, 3(4):409-18.
3. **Bainey R, Armstrong W, Zheng Y *et al.* (2019):** Pharmacoinvasive strategy versus primary percutaneous coronary intervention in ST-elevation myocardial infarction in clinical practice: insights from the Vital Heart Response Registry. Circ Cardiovasc Interv., 12(10):115-9.
4. **Thygesen K, Alpert S, Jaffe S *et al.* (2018):** Fourth Universal Definition of Myocardial Infarction. J Am Coll Cardiol., 72(18):2231-64.
5. **Helal M, Shaheen M, Elhammady A *et al.* (2018):** Primary PCI versus pharmacoinvasive strategy for ST elevation myocardial infarction, IJC Heart & Vasculature, 21:87-93.
6. **Paul A, George V (2017):** Left ventricular global longitudinal strain following revascularization in acute ST elevation myocardial infarction – A comparison of primary angioplasty and Streptokinase-based pharmacoinvasive strategy. Indian Heart Journal, 69:695-9.
7. **Sim S, Jeong H, Ahn Y *et al.* (2016):** Pharmacoinvasive Strategy Versus Primary Percutaneous Coronary Intervention in Patients With ST-Segment– Elevation Myocardial Infarction, A Propensity Score–Matched Analysis. Circ Cardiovasc Interv., 9:e003508. doi: 10.1161/CIRCINTERVENTIONS.115.003508
8. **Kawecki D, Gierlotka M, Morawiec B *et al.* (2017):** Direct Admission Versus Interhospital Transfer for Primary Percutaneous Coronary Intervention in ST-Segment Elevation Myocardial Infarction. JACC Cardiovasc Interv., 10(5):438-47.
9. **Sierra-Fragoso A, Galván-García E, Vargas-Ramírez F *et al.* (2018):** Pharmacoinvasive strategy versus primary angioplasty in patients with acute ST-segment elevation myocardial infarction, Revista Mexicana de Cardiología, 29(3):126-33.
10. **Rathod S, Jain K, Firoozi S *et al.* (2020):** Outcome of inter-hospital transfer versus direct admission for primary percutaneous coronary intervention: An observational study of 25,315 patients with ST-elevation myocardial infarction from the London Heart Attack Group. European Heart Journal Acute Cardiovascular Care, 9(8):948-57.
11. **Chacón-Diaz M, Custodio-Sánchez P, De la Cuba R *et al.* (2022):** Outcomes in ST-segment elevation myocardial infarction treated with primary percutaneous coronary intervention or pharmacoinvasive strategy in a Latin American country, BMC Cardiovascular Disorders, 22:296-300.
12. **Zubaid M, Khraishah H, Alahmad B *et al.* (2020):** Efficacy and Safety of Pharmacoinvasive Strategy Compared to Primary Percutaneous Coronary Intervention in the Management of ST-Segment Elevation Myocardial Infarction: A Prospective Country-Wide Registry. Annals of Global Health, 86(1):13:1-10. doi: 10.5334/aogh.2632
13. **Abdul-Aziz S, Abd Elmageed M, Elsawasany A (2021):** Additive Value Of Three Dimensions Echocardiography Parameters To Grace Cardiology 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. Al-Azhar International Medical Journal, 2(8):18-24. doi: 10.21608/aimj.2021.79947.1497