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Left Ventricular Global Longitudinal Strain after Revascularization of Acute ST- Segment Elevation Myocardial Infarction.

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Abstract: **Background**: Speckle tracking echocardiography (STE) cannot be considered are cent technique any more. Its high feasibility, reproducibility, and accuracy have been widely demonstrated and it has been applied to different aspects of the daily clinical practice specially is chemic heart disease and patients who present with ST segment elevation acute myocardial infarction (STEMI). **Objectives**: The aim of this study is to compare LV regional and global function assessed by 2D-speckle tracking imaging between STEMI patients reperfused by primary Percutaneous Coronary Intervention (PCI) and those reperfused by thrombolytic therapy and pharmaco invasive PCI. **Methods**: Two hundred patients presenting with a cute STEMI, 100f the maunder went primary percutaneous coronary intervention (PCI) received fibrinolytic therapy then pharmaco invasive PCI were enrolled. Left ventricular global longitudinal strain (GLS) was calculated in both groups after the PCI. **Results**: 200 patients (138 males, 62 females) with manage of 58.6±11.0 years were evaluated. The results showed a significant difference between GLS of both groups in favor of group I treated with Primary PCI with mean GLS of 13.892±1.656% in group Ian mean GLS of 11. 18 ± 2.207% in group II (P value<0.001). Left ventricular rejection fraction was assessed also by M-mode echocardiography but there was no statistical significant difference between both groups (P value=0.094). **Conclusion**: primary PCI has a better impact on post revascularization left ventricular systolic function than pharmacoinvasive PCI assessed by measuring left ventricular Global longitudinal strain using 2D-speckle tracking echocardiography which appeared to be more sensitive tool than the traditional left ventricular ejection fraction assessment with M-mode echocardiography for assessment of LV systolic function.
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Keywords: Left; Ventricular; Global; Longitudinal; Strain; Revascularization; Acute ST; Segment; Elevation; Myocardial Infarction

1. Introduction:

Speckle tracking echocardiography (STE) allows to trackthedis placement of “speckles” in two-dimensional (2D) echocardiographic images in an angle-independent way and to assess their movement (strain) during the cardiac cycle. Its high feasibility, reproducibility, and accuracy have been widely demonstrated and it has been applied to different aspects of the daily clinical practice especially ischemic heart disease and patients who present with ST segment elevation acute myocardial infarction (STEMI)[1]. STE allows tracking the displacement of “speckles” in two-dimensional (2D) echocardiographic images in an angle-independent way and to assess their movement (strain) during the cardiac cycle. Its high feasibility, reproducibility, and accuracy have been widely demonstrated and it has been applied to different aspects of the daily clinical practice especially ischemic heart disease and patients who present with ST segment elevation acute myocardial infarction (STEMI) [1].

Ischemic heart disease is considered the most common cause of death, worldwide. It accounts for1.8 million deaths annually in Europe alone. According to the center for disease control it's the most common cause of deaths in Egypt accounting for more than one fifth of the total death count per year (21%), followed by stroke, then cancer[2].

All patients with STEMI should have an early assessment of short term risk including an evaluation of the extent of myocardial damage, the occurrence of successful reperfusion and the presence of clinical markers of high risk for further events including older age, fast heart rate, hypotension, Killip class >I, anterior MI, previous MI, elevated initial serum creatinine, history of heart failure, orperipheral arterial disease[3].

All patients should also have an evaluation of long-term risk before discharge, including LV systolic

function and remodeling, severity of CAD and completeness of coronary revascularization, residual ischaemia, occurrence of complications during hospitalization, and levels of metabolic riskmarkers[4].

In recent STEMI, LV remodeling presents one of the most important prognostic determinants and it tends to be more pronounced as the patient is treated long aftersymptomonset[1]. Speckle tracking echocardiography represents an advanced, non invasive imaging modality that allows a fast and accurate assessment of the global and regional function of both trial and ventricular chambers with evaluation of chamber remodeling, independently from the angle of intonation and in-plane translational motion1.

2. Materials and Methods.

This study was carried out on 200 patients who were diagnosed with first time STEMI at The Cardiology Department at Tanta University Hospital, in a period of six months starting from June2018. The diagnosis of STEMI was made according to recent 2017 European Society of cardiology guidelines[3]. The onset of chest pain to first medical contact (FMC) did not exceed 12hrs. They were divided into two groups. Group 1 comprised of 100patients who had primary PCI as a reperfusion strategy, group II comprised of 100 patients who had pharmacoinvasive technique (PI) as a reperfusion strategy in which patients received streptokinase IV infusion followed by coronary angiography, either immediately orwithin3-24 hrs. Successful thrombolysis was assessed by chest pain relief, decrease in ST segment elevation by> 50% compared to the initial electrocardiogram (ECG), appearance of reperfusion arrhythmia and shooting of cardiac enzymes. Reperfusion success in coronary angiography is measured by the thrombolysis in myocardial in farction (TIMI) blood flow grade; reperfusion was considered successful (TIMI 3) or abnormal (TIMI0-1-2) according to the TIMI blood flow grade[3]. The primary PCI was done with or without stenting.

Exclusion criteria included Presentation after12 hours of onset of chest pain, history or ECG evidence of prior revolved myocardial infarction, past history of documented LV dysfunction or history of cardiac failure, Killipclass III or IV at time of presentation and patients with failed PCI or failed fibrinolytic therapy.

The study compared between the two groups during hospitalization according to the clinical outcomes (mortality, majored verse cardiac events (MACE) as heart failure symptoms, arrhythmias, bleeding complications), angiographic findings (base line TIMI flow score and final TIMI score, single or multi-vessel disease) and angiographic complications as occurrence of contrast induced nephropathy (CIN) and cerebrovascular events. Left ventricular systolic function was then assessed by measuring global longitudinal strain using 2D- speckle tracking echocardiography and ejection fraction measurement by traditional M-mode echocardiography and modified Simpson method then comparing between both groups regarding the results.

The study protocol was reviewed and approved by the Ethics Committee (at Tanta Faculty of medicine) All patients were verbally informed and agreed to share in the study.

Statistical Analysis:

Data were analyzed using IBMSPSS software package version 20.0. (Armonk, NY: IBM Corp). Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. Significance of the obtained results was judged at the5%level. The used tests were Chi-square test (2), Fisher's Exact or Monte Carlo correction, Student t-test, Mann Whitney test and Kruskal Wallis test.

3. Results:

Patient demographics:

The mean age in group I was 56±10.735 years and 55.24 ±9.22 years in group II without statistical significant difference (p=0.107). No statistical significant differences between the two group sin regarding to gender (p=0.107)

Prevalence of risk factors: there was no statistically significant difference between the two groups regarding coronary artery disease risk factor (diabetes mellitus, hypertension, dyslipidemia and smoking status) (Table 1)

Clinical presentation:

According to time from onset of symptoms to first medical contact (FMC), the symptoms duration of the study population ranged from 30 minutes to 12 hours with median 5.5 hrs and 4hrs in group I and II respectively (P=0.132), (Table 2).

Most cases presented by anterior STEMI, 69 patients (69%) of group I and 60 patients (60%) of group II. Sixty-sex patients were diagnosed by inferior STEMI, 28patients (28%) of group I and 37 patients (37%) of group II. Six patients were diagnosed by lateral STEMI, 3 patients (3%) of both group I and group II (Table 2).

In group I,69 patients presented with Killipclass I (69 %), 27 patients presented with Killip class II (27%) and 4 patients presented with Killipclass III (4.0%), while in group II, 87 patients presented with Killipclass I (87%), 10 patients presented with Killip class II (10%) and3patients presented with Killipclass

III (3%) that were statistically significance (P= 0.004), (Table 2).

Regarding the systolic blood pressure (SBP), in group I, SBP ranged from 100.0–180.0 mmHg with a meanof127.4±19.0. In group II, it ranged from 100.0–150.0mm Hg with a mean of 135.0±12.10. (P =0.001) with statistical significance. The diastolic blood pressure (DBP) of the study population, in group I, DBP ranged from 60.0–110.0mm Hg with a mean of 76.70±11.01. In group II, it ranged from 60.0–100.0mm Hg with a mean of 74.80±10.10. (P=0.205), (Table2)

The pulse of the study population ranged from40–120beatsperminute (bpm). In group I, the pulse ranged from 40.0–120.0bpm with a mean of 82.40±17.41. In group II, it ranged from 50.0–100.0bpm with a meanof77.55 ±11.67. (P=0.022). According to the presenting rhythm, in group I, 96 patients presented with sinus rhythm (96%), two patients presented by a trial fibrillation and two patients by complete heart block (4.0%).

In group II, 95patients presented with sinus rhythm (95%), 2patients by a trial fibrillation and 3 by complete heart block (5.0%). (P=1.000), (Table2).

Door to reperfusion method:

For group I, door to balloon time ranged from 15-120 minutes with mean duration 61.15 ± 20.07 minutes. For group II, time to IV bolus of thrombolytic ranged from 5-20 minutes with mean duration 14.22 ± 3.51 minutes, and time from end of thrombolytic therapy to PCI ranged from 2- 120 minutes with mean duration 18.51 ± 16.25 minutes.

Angiographic finding: There was no statistical significant difference regarding PCI access (P = 0.269) and number of diseased vessel (P =1.000). In group I, the infarcted related artery (IRA) was the left anterior descending coronary artery (LAD) in 74 patients (74%), the left circumflex coronary artery (LCX) in 11 patients (11%) and the right coronary artery (RCA) in 15 patients (15%). In group II, the IRA was the LAD in 65 patients (65%), the LCX in 10 patients (10%) and the RCA in 25 patients (25%). There was no statistically significant difference between the two groups (P =0.209).

According to type on intervention, percutaneous transluminal coronary angioplasty (PTCA) was used in 71 patients of group I (71%) and in 58 patients of group II (58%). There was no statistically significant difference between the two groups (P value =0.055).

Stents were used in 180 patients. In group I bare metal stents (BMS) were used in 25 patients (25%) and drug eluting stents (DES) in 60 patients (60%). In group II, BMS were used in 7 patients (7%) and DES in 88 patients (88%). There was statistically significant difference between the two groups (P value< 0.001).

TIMI= **thrombolysis in myocardial infarction, CHF** = Congestive heart failure, LAD=left anterior disending. LCX= left circumflex. RCA=right coronary artery, NS= non-significant Base line TIMI flow, in group I, 91 patients (91%) had TIMI flow < 3, and 9 patients had TIMI III flow (9%). While in group II 50 patients had TIMI flow < 3 (50%), and 50 patients had TIMI III flow (50%) with statistical significant difference (P <0.001) (Figure 1). While final TIMI flow showed no statistical significant difference, final TIMI III was achieved in 90 patients (90%) in group I and 95 patients (95%) in group II (P = 0.179), (Table 3, Figures 2,3).

Major adverse cardiac events:

During hospital admission, mortality occurred in 4 patients (4%) in group I versus 7 patients (7%) in group II with no statistical significant difference. (p=0.352), congestive heart failure 9% versus 13% (p=0.366) respectively. No cases of re-infarction were recorded during hospital admission. Bleeding complications were more significant in group II than group I, 19 patients (19%) in group II versus 6 patients (6%) of group I (P = 0.005), (Table 3). After 30-days follow up, mortality occurred in 3patients (3%) of both group I and group II (p = 0.635), congestive heart failure occurred in 8patients (8%) in group I versus 3 patients (3%) in group II (p = 0.211). Reinfarction occurred only in3 patients (3%) of group II and did not occur in group I patients (p = 0.139), (Table 3) Echocardiographic findings: The assessment of LV systolic function shows median ejection fraction (EF) 50% and 45% in group I and group II respectively (P =0.682), while after 30-days follow up median EF was 50% in both groups (P = 0.488) with no statistical significant difference.

Table (1) Baseline clinical, demographic characteristics of studied groups

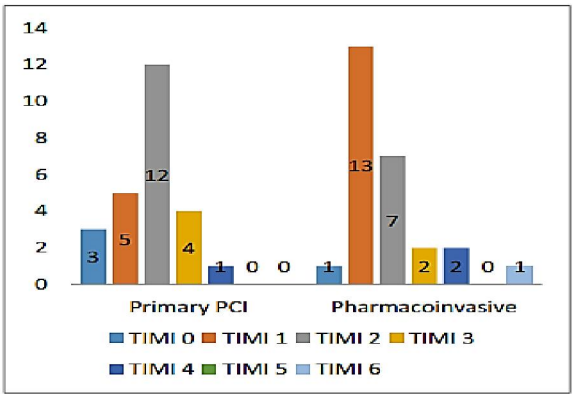
Risk Factors	**Group I (n =100)**	**Group II (n =100)**	**$\chi 2$**	**p**
Diabetes Mellitus (**No.%**)	37(37%)	33(33%)	0.32	0.571
Hypertension (**No.%**)	36(36%)	36(36%)		1
Smoking (**No.%**)	56 (56%)	52(52%)	1.47	0.225
FH of premature CAD (**No.%**)	10(10%)	18(18%)		0.417
Dyslipidaemia	66(66%)	40(40%)	1.587	0.208

Table (2) Clinical characteristics of the studied groups.

	Group I		Group II		Test of Sig.	p
	No.	%	No.	%		
Time from onset of symptoms to FMC (Hours)						
Min.– Max.	0.50 –12.0		1.0 – 12.0		U= 4390.0	0.132
Mean±SD.	5.97 ±4.05		4.63 ±2.54			
Median	5.50		4.0			
Pulse (beat/min.)						
Min.– Max.	40.0 – 120.0		50.0 – 100.0		t= 2.314	0.022
Mean±SD.	17.41±82.40		11.67±77.55			
Median	80.0		77.50			
Killip Class						
1	69	69.0	87	87.0	$\chi2$=10.158	MCP=0.004
2	27	27.0	10	10.0		
3	4	4.0	3	3.0		
Systolic blood pressure (mmHg)						
Min.– Max.	100.0 –180.0		100.0 – 150.0		t= 3.374	0.001
Mean±SD.	19.0±127.4		12.10±135.0			
Median	125.0		140.0			
Diastolic blood pressure (mmHg)						
Min.– Max.	60.0 – 110.0		60.0 – 100.0		t=1.271	0.205
Mean±SD.	11.01±76.70		10.10±74.80			
Median	70.0		70.0			
Location of infarction						
Anterior STEMI	69	69.0	60	60.0	$\chi2$=1.947	MCp=0.414
Inferior STEMI	28	28.0	37	37.0		
Lateral STEMI	3	3.0	3	3.0		

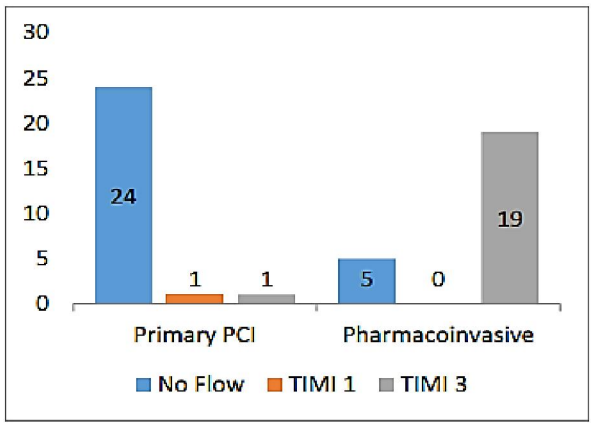
Table (3) Comparison between the two studied groups according to TIMI flow score (base line and final) and MACE during hospital stay and during30 days follow-up.

		Group I		Group II		Test of Sig.	p
		No.	%	No.	%		
TIMI	**Baseline**						
	<3	91	91.0	50	50.0	$\chi2$=40.414	<0.001
	3	9	9.0	50	50.0		
	Final						
	<3	10	10.0	5	5.0	$\chi2$=1.802	0.179
	3	90	90.0	95	95.0		
Angiographic finding in the two studied groups							
		Group I (n=100)		**Group II (n=100)**			**p**
Multivessel disease		44(44%)		46(46%)			**Ns**
Infarct-related artery							
LAD		70(70%)		62(62%)			Ns
LCX		9(9%)		10(10%)			
RCA		21(21%)		26(26%)			
Major adverse cardiacevents during hospital stay in the study population							
Complication		**Group I (n=100)**		**Group II (n=100)**		$\chi2$	FEp
		No.	**%**	**No.**	**%**		
In hospital Mortality		4	4.0	7	7.0	0.866	0.352
Re-infarction		0	0.0	0	0.0	-	-
Bleeding complication		6	6.0	19	19.0	7.726	0.005
CHF		9	9.0	13	13.0	0.817	0.366
Major adverse cardiacevents during 30-daysfollowupinthe study population							
Complication		**Group I**		**Group II**		$\chi2$	FEp
		No.	**%**	**No.**	**%**		
30daysfollowup Mortality		3	3.0	3	3.0	0.934	0.635
30 days Re-infarction		0	0.0	3	3.0	3.603	0.139
30 days CHF		8	8.0	3	3.0	3.113	0.211



TIMI=thrombolysis in myocardial infarction, PCI=primary percutaneous coronary intervention

Figure (1) TIMI score in both groups



TIMI=thrombolysis in myocardial infarction, PCI=primary percutaneous coronary intervention

Figure (2) TIMI flow pre PCI in both groups

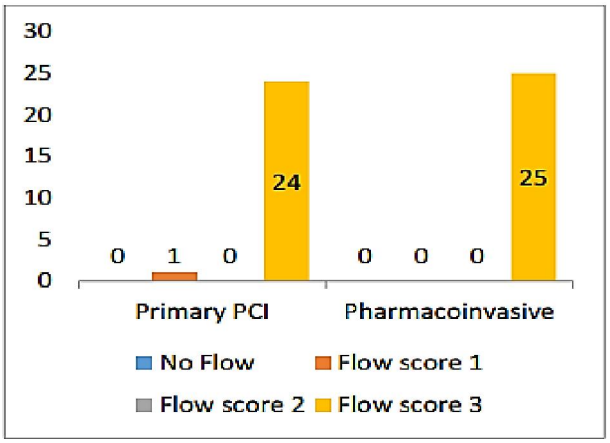
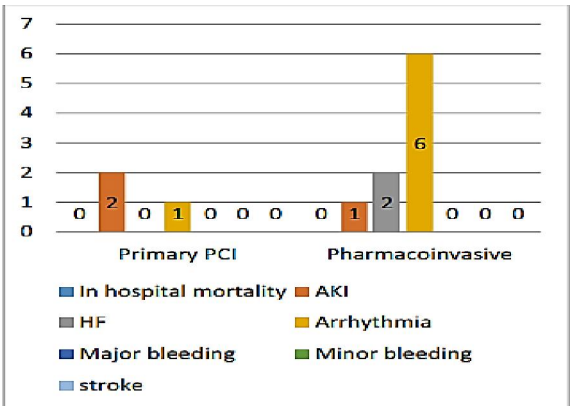


Figure (3) TIMI flow post PCI in both groups



AKI= acute kidney injury HF=heart failure

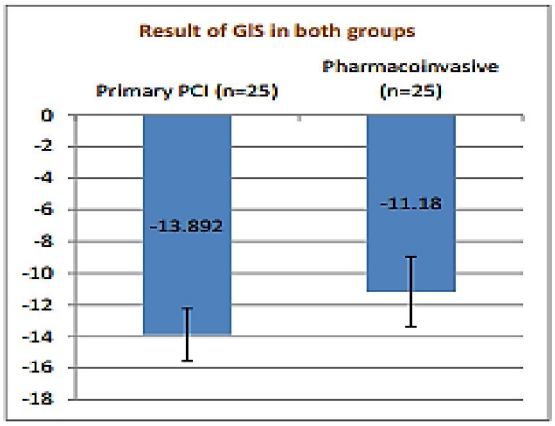
Figure (4) Complications in both groups

Assessment of the left ventricular systolic function by M-Mode echocardiography before Discharge:

EF of the study population ranged from30% to 71% with mean EF of 46.44% ± 8.42%. In-group I, EF ranged from 37% to 65% with mean EF of 48.44% ± 6.41%. In group II, EF ranged from 30% to 71% with mean EF of 44.44% ±9.768%. There was no statistically significant difference between the two groups (P value=0.094).

Assessment of the GLS (%) by 2D speckle tracking echocardiography before discharge:

GLS of the study population ranged from17.2% to 7.25% with a mean GLS of 12.54 ±2.37%. In group I GLS ranged from 17.2% to11.7% with a mean GLS of 13.892 ± 1.656%. In group II GLS ranged from 15.9% to 7.25% with a mean GLS of 11.18 ± 2.207%. There was a statistically significant difference between both groups (P value<0.001) (Table 4).



GLS= Global longitudinal strain, PCI= primary percutaneous coronary intervention

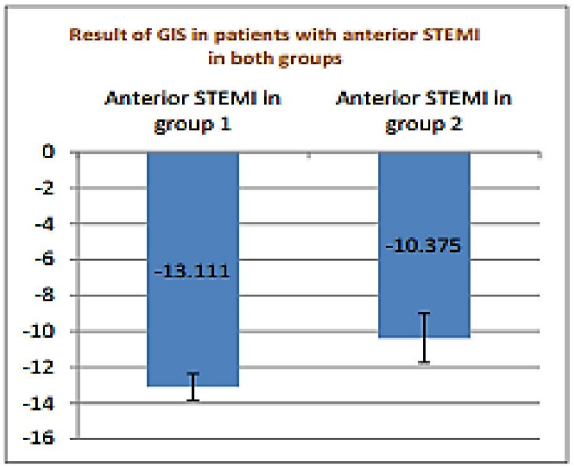
Figure 5: Comparison between GLS of group I and II

Table 4: Compares on between the two studied groups according to GLS

GLS %(50)	Primary PCI (n=100)	Pharmacoinvasive (n=100)	T test	P Value
Mean±SD	13.892±1.656	11.18±2.207	-4.914	<0.001*
Max.-Min	(17.2-11.7)	(15.9-7.25)		
Comparison between GLS of patients with anterior STEMI in both groups				
GLS %(36)	Anterior STEMI in group I	Anterior STEMI in group II	T test	P Value
Mean±SD	-13.111±0.75	-10.375±1.378	-7.398	<0.001*
Max.-Min	(-14.2- -11.7)	(-12.1--7.25)		
Comparison between GLS of patients with anterior STEMI in both groups				
GLS %(14)	Inferior STEMI in group I	Inferior STEMI in group II	T test	P Value
Mean±SD	-15.9±1.685	-13.251±2.674	-2.217	0.0506
Max.-Min	(-17.2 --12.4)	(-15.9 --8.7)		
Comparison between GLS of patients with single vessel disease in both groups				
GLS %(40)	Single vessel in group I	Single vessel in group II	T test	P Value
Mean±SD	-14.285±1.611	-11.63±2.172	-4.389	0.0001*
Max.-Min	(-17.2 --11.9)	(-15.9 --7.25)		
Comparison between GLS of patients with multi vessel disease in both groups				
GLS% (10)	Multivessel in group I	Single vessel in group II	T test	P Value
Mean±SD	12.32±0.512	-9.38±1.322	-4.638	0.005*
Max.-Min	(12.9- -11.7)	(-10.6 --7.5)		

GLS=Global longitudinal strain

Significant difference between both groups (P value <0.001) (Table4).



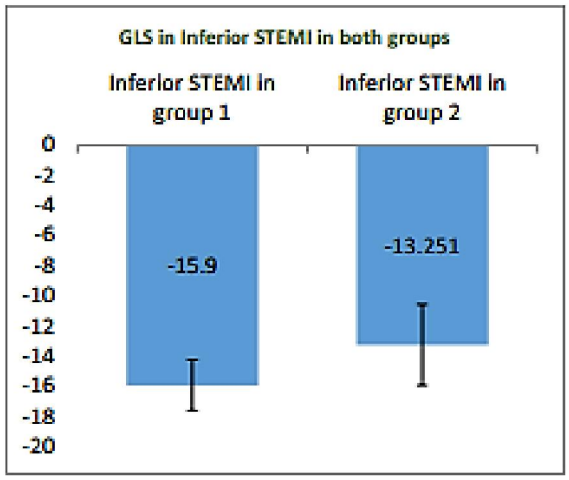
Strain of patients with anterior STEMI in both group

GLS= Global longitudinal strain, STEMI= ST elevation myocardial infarction

Figure 6: Comparison between global longitudinal

In patients presenting with Anterior STEMI in group I (69 patients), GLS ranged from 14.2% to 11.7% with a mean GLS of 13.111 ± 0.75% while in those in group II (60 patients), GLS ranged from -12.1% to 7.25% with a mean GLS of 10.375 ± 1.378%. There was a statistically.

Inpatients presenting with Inferior STEMI in group I (28 patients), GLS ranged from 17.2% to 12.4% with a mean GLS of 15.9±1.685% while in those in group II (37 patients) GLS ranged from 15.9% to 8.7% with a mean GLS of 13.251±2.674. There was no statistically significant difference between both groups (P value=0.0506) (Table 4).



GLS= Global longitudinal strain, STEMI= ST elevation myocardial infarction

Figure 7: Comparison between global longitudinal strain of patients with inferior STEMI in both group

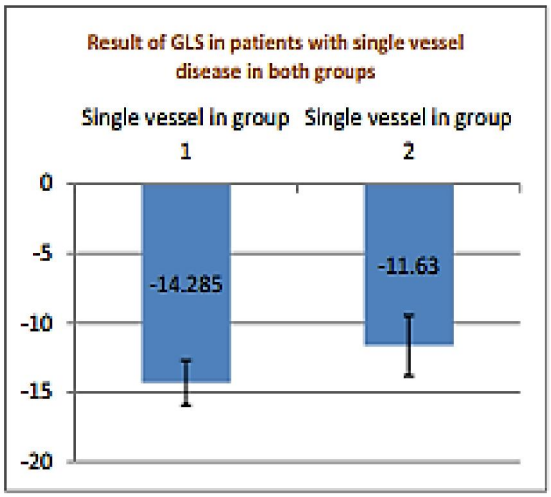


Figure 8: Comparison between GLS of patients with single vessel disease in both groups. GLS=Global longitudinal strain

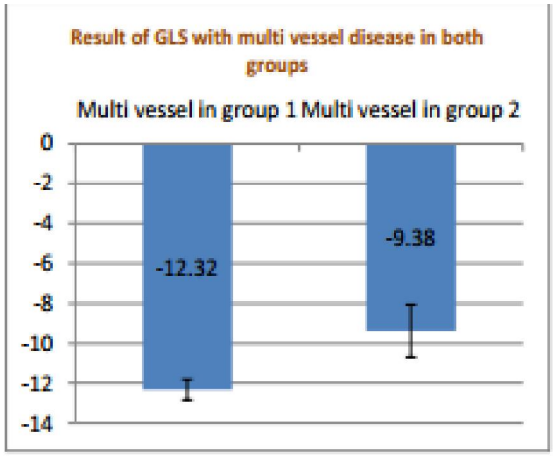


Figure 9: Comparison between GLS of patients with multivessel disease in both groups. GLS= Global longitudinal strain

In patients presenting with single vessel disease in group I (20 patients), GLS ranged from 17.2% to -11.9% with a mean GLS of -14.285 ± 1.611% while in those in group II (20 patients also), GLS ranged from 15.9% to 7.25% with a mean GLS of 11.63±2.172%. There was a statistically significant difference between both groups (P value=0.0001) (Table 4). In patients presenting with multivessel disease in group I (44 patients), GLS ranged from 12.9% to 11.7% with a mean GLS of 12.32 ± 0.512% while in group II (46 patients), GLS ranged from -10.6% to 7.5% with a mean GLS of 9.38 ± 1.322%. There was a statistically significant difference between both groups (P value=0.005)

4. Discussion

Reperfusion treatment in acute myocardial infarction aims at early and sustained reperfusion of the myocardium at risk. Traditionally, reperfusion can be obtained by thrombolysis or by pPCI5. Although pPCI is the preferred reperfusion method for STEMI, it remains difficult to implement in many areas, and fibrinolytic therapy is still widely used. In the past 10 years, evidence has been brought that fibrinolytic treatment should not be used as stand-alone therapy, but rather as part of a pharmacoinvasive strategy, with the patients brought to PCI capable facilities after fibrinolysis, to perform semiurgent coronary angiography and secondary PCI, when necessary 6.

In daily clinical practice, thrombolytic therapy is still used to manage STEMI due to logistical issues and lack of pPCI capable centres in developing countries. The Cardiology Department in Tanta University Hospital (TUH) is a primary PCI capable center; however, thrombolytic therapy is still being used for reasons as financial issues, insurance coverage, reimbursement. In addition, many cases receive thrombolytic therapy in other centres before being transported to TUH. Based on this pharmacoinvasive protocol is being used for many cases. In the current study 70 patients were diabetics (35%), and 87 were hypertensive (36.0%), while 108 were active smokers (54%) this came in agreement with a study conducted by Chow et al. Smoking has a strong pro-thrombotic effect, and smoking cessation is potentially the most cost effective of all secondary prevention measures.7 The majority of cases presented by anterior STEMI and patients presenting by Killip class I represented majority of the study population, This came in agreement by the STREAM trial in which the majority of cases presented by anterior STEMI and patients presenting by Killip class I represented majority of their study population8. Both study groups were compared regarding base line TIMI flow in coronary angiography. In group II, treated with fibrinolytic agents 50% of cases achieved TIMI III flow. While 50 patients achieved either TIMI flow 0, 1 or 2 (50%) of which urgent angiography and PCI was required in 19 patients who didn't meet criteria of successful reperfusion by thrombolytic therapy (19%), the remainder cases underwent timely arranged coronary angiography and PCI within 24 hours. But as would be expected in group I, only 10 cases achieved base line TIMI III flow (10%) and remainder patients of the study group achieved either TIMI 0, 1 or 2 (90%), (P < 0.001). After PCI, patency rates were high in the two study groups with final TIMI III achieved in 90% and 95% of patients in group I and II respectively. Of those undergoing PCI, stenting was required in 85 cases of group I (85%) and 95 cases of group II (95%) while no stenting required for 15 cases

of group I (15%) and 5 cases of group II (5%). (P < 0.179). This came in concordance with the STREAM trial, in the group treated by fibrinolysis most patients presented by base line TIMI III 58.5% while in the group treated by primary PCI most patients achieved base line TIMI 0 (59.3%). but the final TIMI III flow was achieved similarly in the group treated by pharmacoinvasive technique and group treated by primary PCI 91% and 92% respectively.8 Also, in the FAST-MI trial initial TIMI flow for group treated by primary PCI in 18% of patients. And 37% of patients treated by fibrinolysis. While the final TIMI flow was 89% in group treated by primary PCI and 84% in patients treated by fibrinolysis.6 **Regarding in-hospital MACE**: 4 cases of group I, died during admission (4%) compared to 7 cases (7%) of group II, (P=0.352). and regarding angiographic complication there were no significant difference in both groups. Bleeding complication occurred more in the pharmacoinvasive arm compared with primary PCI arm with 19 patients suffered from different types of bleeding complication (19%) compared to 6 patients of group I (6%).

Regarding major adverse outcome during 30 days follow up:

During follow up visit, there were similarities in both groups regarding all-cause mortality 3 patients of group I and 3 of group II died during one month follow up, (P = 0.635). Also, MACE (congestive heart failure and re-infarction) P = 0.211 and P = 0.139 respectively. This came in agreement with the STREAM trial, which compared outcomes in patients treated with Pharmacoinvasive therapy or Primary PCI presenting within 3 h after symptom onset, unable to undergo Primary PCI within 1 hr. The primary end point was a composite of death, shock, congestive heart failure, or reinfarction up to 30 days, the primary end point occurred in (12.4%) in the fibrinolysis group and in (14.3%) in the primary PCI group. More intracranial haemorrhages occurred in the fibrinolysis group than in the primary PCI group.8 Also, Larson et al conducted a prospective registry data from a large regional STEMI system (the Minneapolis Heart Institute Foundation), involving 2624 consecutive STEMI patients and 31 referring non-PCI hospitals demonstrated the safety and efficacy of a pharmacoinvasive reperfusion strategy in rural patients who had expected delays to PCI owing to long-distance transfers. STEMI patients who were transferred from hospitals more than 60 miles from the PCI hospital received fibrinolytic therapy were transferred for immediate PCI. There were no differences in 30-day mortality (5.5% vs 5.6%; P = 0.94), stroke (1.1% vs 1.3%; P = 0.66), major bleeding (1.5% vs 1.8%; P = 0.65), or reinfarction ischemia (1.2% vs 2.5%; P = 0.088) in patients receiving a pharmacoinvasive strategy compared with patients presenting directly to the PCI center for primary PCI, despite a 93 minute longer door to balloon time.9 In the FAST-MI trial, they assessed 5-year mortality in STEMI patients from the French registry of Acute ST-elevation or non-ST elevation Myocardial Infarction (FAST-MI) in 2005 according to use and type of reperfusion therapy. Of 1492 STEMI patients with first call <12 hours from onset, 447 (30%) received fibrinolysis (66% pre-hospital; 97% with subsequent angiography, 84% with subsequent PCI), 583 (39%) had pPCI and 462 (31%) received no reperfusion. There was a numerical excess of reinfarction, stroke, and ventricular fibrillation with the fibrinolytic-based strategy, and an excess of cardiogenic shock with primary PCI. However, none of the in-hospital complications differed significantly for the two reperfusion strategies. In the FAST-MI trial major bleeding complication occurred more with the primary PCI arm with no statistical difference (P = 0.29).10 The Comparison of Angioplasty and Prehospital Thrombolysis in Acute Myocardial Infarction (CAPTIM) trial, has suggested that prehospital fibrinolytic therapy with the patients brought to PCI-capable centers and with one third undergoing rescue angioplasty, could do at least as well as primary PCI up to 5 years after the initial episode. Also a pooled analysis of the CAPTIM and Which Early ST-Elevation Myocardial Infarction Therapy (WEST) trials found a reduction in one year mortality with fibrinolysis in patients seen early.11 **Regarding difference between the two groups regarding M-mode assessment of left ventricular ejection fraction (LVEF):**

It was found that M-mode echocardiographic assessment of LVEF showed non-significant differences between the two groups with a mean ejection fraction 48.84 ± 6.41 SD % and 44.44 ± 9.768 SD % in group I and group II respectively (P value= 0.094). **Regarding difference in left ventricular global longitudinal strain (GLS) (%):** In contrast to LVEF, there was a statistically significant difference between both groups with mean GLS of -13.892 ± 1.656 in patients of group I and -11.18 ± 2.207 in patients of group II in favor of group I. A study conducted by **Elizabeth Potter et al** suggested that normal values ranged from 15.9% to 22.1% (mean 19.7%; 95% CI: 20.4 to 18.9%), Strain declines with age (without a significant drop in LVEF) but sex has a more significant impact on normal strain values. In the general population (without cardiovascular disease or traditional risk factors), the absolute GLS difference between men and women is >1%.12 The same study had showed that GLS improves detection of systolic dysfunction beyond LVEF and has revealed additional

pathological features in scenarios where diastolic dysfunction has been considered the singular or defining abnormality.12 **Vartdal et al** demonstrated that LV global peak negative strain by Doppler predicts infarct size better than LVEF by echocardiography in patients with acute anterior myocardial infarction 1.5 hours after primary percutaneous coronary intervention.13 This came in agreement with the study conducted by **Benthe Sjøli et al** that compared Left Ventricular Ejection Fraction and Left Ventricular Global Strain as Determinants of Infarct Size in Patients with Acute Myocardial Infarction using contrast-enhanced cardiac magnetic resonance (ceCMR) as the reference method and confirmed these results and that LV global strain measured in the acute phase of AMI predicts infarct size better than LVEF.14 Thus, LV global strain seems to have several advantages over LVEF by echocardiography in the evaluation of infarct size and LV function in patients with AMI.14 Additionally, comparing GLS between subgroups of both group I and II such as between patients with anterior STEMI of both groups or those with single vessel disease or multivessel disease was in favor of subgroups belonging to group I (Anterior STEMI, single vessel and multivessel disease patients of group I had GLS better than that of Anterior STEMI, single vessel and multivessel disease patients of group II respectively). As is demonstrated in this study, primary angioplasty appears better than streptokinase-based pharmacoinvasive strategy in terms of post revascularization LV function, even in patients without heart failure or shock at presentation.

Limitations of the Study

First, small numbers of study population, due to most patients who receive thrombolytic therapy with signs of successful reperfusion undergo coronary angiography later after discharging due to financial reasons. Second limitation was the short period assigned for follow up which didn't allow the appearance of results for mortality, re-infarction & re-hospitalization. The chosen period was one month only to prevent fallacies in the results because mostly after one month the patients underwent elective PCI for other coronary lesions, so this may affect the results. Third, the use of M-mode, Simpson's method might not be of the same accuracy in assessment the global & regional LV systolic function as the newest techniques such as speckle tracking & strain and strain rate.

Conclusion

It was shown that primary angioplasty fares better than streptokinase-based pharmacoinvasive strategy in terms of post revascularization LV function which is a strong predictor of adverse outcomes, even in patients without failure or shock at presentation.

Given the fact that 80% of the patients in the pharmacoinvasive arm had patent culprit vessel with TIMI III 3 flow at the time of angiogram, it is possible that the benefits of primary angioplasty extend beyond those attributable to the re-establishment of flow in the culprit vessel.

During hospital stay, mortality and major adverse events were nil due to the strict inclusion and exclusion criteria of the study.

The myocardial salvage, and thereby the post infarction LV function indicated by global longitudinal strain which is a more sensitive measure of LV systolic function following Streptokinase based pharmacoinvasive strategy in acute ST elevation myocardial infarction, fares inferior to primary angioplasty with the positive impact of primary angioplasty in the recovery of myocardial function possibly extends beyond the benefits achieved by the establishment of epicardial coronary arterial flow. Primary angioplasty should remain the reperfusion strategy of choice in acute STEMI wherever feasible with the pharmacoinvasive strategy used as a safe alternative.

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