Left Ventricular Function Assessment in Anterior Myocardial Infarction Patients at Suez Canal University Hospital

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Abstract:

Background: Worldwide, myocardial infarction (MI) continues to be the primary cause of mortality. For many years, the leading cause of morbidity worldwide has been coronary artery disease (CAD). **Aim**: This study aimed to assess the Left ventricular function in patient with Ant. Myocardial Infarction at Emergency Department in Suez Canal University hospital. **Patients and methods**: This case control study was conducted in the Emergency room (ER) of the Suez Canal university Hospital. It included 60 participants which divided to two groups; group 1included 30 patients had anterior myocardial infarction attending to the ER of the Suez Canal university Hospital and group 2 included 30 matched study group in age, sex, and risk factors with no MI. **Results**: Our study results have revealed that MI group had statistically significant higher medical history of HTN ($p=0.001$), DM ($p=0.005$), IHD ($p< 0.001$), smoking ($p< 0.001$), than the control group, the mean pulse of the MI group was (90.60 ± 11.941 BPM) statistically significantly higher than in control group (82.60 ± 8.712 BPM), ($p= 0.004$). The mean MAP of the MI group was (90.60 ± 8.633 mmHg), while in control group it was (90.77 ± 7.224 mmHg), with no statistically significant difference between the two groups regarding MAP ($p= 0.936$). The mean left ventricle diastolic diameter (5.26 ± 0.637cm) and left ventricle systolic diameter (3.85 ± 0.743 cm) in the MI group were statistically significantly higher than in the control group. The mean interventricular septal thickness (12.11 ± 2.757 mm) and posterior wall thickness (13.54 ± 3.838 mm) in the MI group were statistically significantly higher than in the control group. **Conclusion**: Patients with acute MI, including those with clinical HF, often did not receive left ventricular evaluation during their hospital stay, despite research showing that doing so was linked to higher-quality treatment.

Keywords: myocardial infarction, ST-segment elevation myocardial infarction, coronary artery disease.

1. Introduction:

Worldwide, myocardial infarction (MI) continues to be the primary cause of mortality. For many years, coronary artery disease (CAD) has been the leading cause of morbidity worldwide [(1)].

The irreversible necrosis of heart muscle brought on by a reduction in the heart's blood supply as a result of coronary artery obstruction is known as myocardial infarction. When there is evidence of acute myocardial ischemia (backed by either patient symptoms, EKG abnormalities, or imaging data), and increasing cardiac biomarkers identify the acute myocardial damage, MI is diagnosed clinically [(2)].

A reduction in blood flow to the heart's anterior wall is linked to anterior myocardial infarction [(3)]. Based on EKG results, anterior myocardial infarction is classified as follows: There are four types of ST-segment elevation in leads: antero-septal (in leads V1 to V4), antero-apical (or mid-anterior) (in leads V3 to V4), anterolateral (in leads V3 to V6), and extended anterior (in leads V1 to V6) [(4)].

Following an acute myocardial infarction, there is a known correlation between in-creased short- and long-term mortality and left ventricular dysfunction (LV dysfunction) (AMI). As a result, new tools have been created to enhance left ventricular function, including coronary stents and medications that increase microcirculatory reperfusion while reducing LV remodeling. Thanks to these developments, individuals suffering from ST-segment elevation myocardial infarction (STEMI) now have lower morbidity and fatality rates [(5)].

There hasn't been much research done on how LV dysfunction would affect prognosis if these new procedures are widely used in regular treatment. Furthermore, days to months following the index event, the majority of earlier investigations evaluated LV function. The ability to immediately quantify left ventricular ejection fraction (LVEF) by ventriculography at the time of presentation and revascularization allows for an early evaluation of left ventricular function, since primary percutaneous coronary intervention (PCI) has become the recommended therapy for STEMI. The predictive significance of LVEF evaluated during the primary PCI operation has only been studied once, in a large-scale research conducted more than ten years ago. It is necessary to reevaluate if this approach is still clinically relevant in light of modern therapies [6]. We aimed to assess the left ventricular function in patient with anterior wall myocardial infarction at emergency department in Suez Canal University Hospital.

2. Materials and Methods:

This observational case control study was conducted in the Emergency room (ER) of the Suez Canal university Hospital. The study included two groups with the following criteria: Group 1: All patients had anterior myocardial infarction attending to the ER of the Suez Canal university Hospital and Group 2: Patient matched study group in age, sex, and risk factors with no MI.

Sample size and sampling technic:

A representative sample of 60 participant, a case group containing 30 patients with anterior wall myocardial infarction and a matched control group containing an equal number, patients were recruited from emergency department in Suez Canal University Hospital, Egypt by convenience sampling technic, Open Epi I program was used to calculate the suitable sample size, at confidence interval of 95% and power of 80%.The ability to detect a difference of at least 15% between the case and control groups was wanted; so, the minimum required number of participants in each group was 60 participants.

Inclusion criteria:

- All patients presented with anterior MI (first attack, 1-12 hours of symptoms).
- Both sexes.
- Patients above 20 years old.

Exclusion criteria:

- Patients who had bundle branch block or any other intraventricular conduction delay
- Patients with previous history of MI, valvular disease, heart failure and pulmonary hypertension
- Patients who underwent percutaneous transluminal coronary angioplasty to LAD, critical stenosis >50% in RT coronary artery, circumflex artery.
- Patients transferred from other hospitals after performing any medical or surgical procedure.
- Patients discharge on his demand, transferred to other hospitals or escaped or patient who refused.
- Patients with underlying medical conditions intracranial tumor, epilepsy, stroke, multiple sclerosis, arteriovenous malformation, HIV encephalopathy, brain abscesses, Alzheimer’s disease, Parkinson disease, meningitis affecting results.
- Patients with inferior, posterior and anterolateral MI.

Study procedure:

Each patient was subjected to:

A) Clinical history:

Questionnaire through medical history was filled by patient and/or patient's relatives covering:

- Patient's number.
- Patient's personal data: age, sex, any chronic illness (hypertension, diabetes, ischemic heart disease, chronic liver diseases and renal failure).
- Chest pain analysis (site, character, course, onset, radiation, timing and associated symptoms).

B) Clinical examination of patients:

1- Vital signs: pulse, blood pressure, respiratory rate.

2- Assessment using ABCD approach.

3- Regional examination of chest and heart.

4- Assessment of condition of patient either stable or unstable that determined the needed investigation and plan of management.

C) Investigation:

- Laboratory: complete blood count, cardiac enzyme (creatinine kinase- MB, troponin, Total creatinine kinase), PT, electrolyte, &renal function

- Radiology: chest x-ray

- Then, Echo was done after Reperfusion therapy

- Echocardiography according to Guidelines of 2015: (The contents of Echocardiography used to assess of RT ventricular function):

1. General Recommendations for RV Quantification.

2. Essential Imaging Windows and Views.

3. Assessment of left ventricular dimensions and function.

-The echocardiographic study was carried out to assess RV systolic function and pulmonary hyper-tension according to the recommendations of the American society of cardiology (7). Echo machine with the TDI mode with 2.5-MHz phased array probe was used (General Electric Healthcare Company, Vivid seven Dimensions Vingmed and Horten- Norway). Conventional 2D, M-mode, and Doppler studies were carried out.

Data management and statistical analysis:

SPSS statistics for windows (Statistical Package for the Social Sciences) version 26 (IBM, Armonk, NY, USA) was used for statistical analysis of the collected data. Shapiro-Wilk test was used to check the normality of the data distribution. All tests were conducted with 95% confidence interval. P (probability) value < 0.05 was considered statistically significant. Charts were generated using SPSS' chart builder and Microsoft Excel for windows 2019.

Descriptive statistics: Quantitative variables were expressed as mean and standard deviation while categorical variables were expressed as frequency and percentage.

Continuous Group differences: Independent sample T and Mann Whitney tests were used for inter-group (between subjects) comparison of parametric and non-parametric continuous data with no follow up readings respectively.

Categorical Group differences: Fisher exact and Chi square tests were used for inter-group comparison of nominal data using the crosstabs function.

Correlations: Bivariate correlations were assessed using Pearson's or Spearman's correlation coefficient depending on the nature of data.

Ethical considerations:

Approval from Research Ethics committee (REC) of faculty of Medicine Suez Canal University was obtained before starting field work (code: 3875 on 10/06/2019), in addition an administrative approval was obtained from the dean of the faculty of Medicine.

Informed consent was obtained from all participants who accepted participation in the study after explaining for all candidates the steps of the survey: the aim, the potential benefits and the potential risks and their right to withdraw from the study at any time without affecting the medical services they need. The blocks are safe and used before in clinical studies and their efficacy is well known. The data collected was used only for the purpose of this research. Researcher's contact information was given to the participants for further inquiries. Participants were informed by their results. All methods were performed in accordance with the relevant guidelines and regulations

3. Results:

Table 1 shows the demographic characteristics of the studied groups, it was found that the mean age of MI group was (60.87 ± 11.676 years), while the mean age of the control group (56.60 ± 9.719 years), with no statistically significant difference between the two groups regarding age (p= 0.129).

The mean BMI of MI group was (29.31 ± 2.892 kg/m2), while the mean age of the control group (29.00 ± 3.361 kg/m2), with no statistically significant difference between the two groups regarding age (p= 0.706).

Gender distribution was: MI group contained 29 (96.7%) male participants, and 1 (3.3%) female. Control group contained 27 (90.0%) males and 3 (10.0%) females, with no statistically significant difference between the two groups regarding gender (p= 0.301).

Table 1: Demographic characteristics of the studied groups.

		MI group (n= 30)	**Control group (n= 30)**	**P**
Age (years)		60.87 ± 11.676	56.60 ± 9.719	0.129
BMI (kg/m^2)		29.31 ± 2.892	29.00 ± 3.361	0.706
Gender	Male	29 (96.7%)	27 (90.0%)	0.301
	Female	1 (3.3%)	3 (10.0%)	

Data is expressed as mean and standard deviation or as percentage and frequency. P is significant when < 0.05.

Table 2 illustrates that MI group had statistically significant higher medical history of HTN (p=0.001), DM (p=0.005), IHD (p< 0.001), smoking (p< 0.001), than the control group.

Table 2: Medical history of the studied groups.

	MI group (n= 30)	**Control group (n= 30)**	**P**
History of hypertension	9 (30.0%)	0 (0%)	0.001
History of DM	7 (23.3%)	0 (0%)	0.005
History of IHD	18 (60.0%)	0 (0%)	< 0.001
History of liver disease	1 (3.3%)	0 (0%)	0.313
History of Renal failure	1 (3.3%)	0 (0%)	0.313
Smoking	16 (53.3%)	0 (0.0%)	< 0.001

Data is expressed as percentage and frequency. P is significant when < 0.05.

DM: Diabetes mellitus, IHD: Ischemic heart disease.

Table 3 demonstrates the vital signs on admission of the studied groups, it was found that the mean pulse of the MI group was (90.60 ± 11.941 BPM) statistically significantly higher than in control group (82.60 ± 8.712 BPM), (p= 0.004).

The mean MAP of the MI group was (90.60 ± 8.633 mmHg), while in control group it was (90.77 ± 7.224 mmHg), with no statistically significant difference between the two groups regarding MAP (p= 0.936).

Table 3: Vital signs on admission of the studied groups:

	MI group (n= 30)	**Control group (n= 30)**	**P**
Pulse (BPM)	90.60 ± 11.941	82.60 ± 8.712	0.004
MAP (mmHg)	90.60 ± 8.633	90.77 ± 7.224	0.936

MAP: Mean arterial blood pressure

Table 4 shows the echocardiographic assessment of left ventricle in the studied groups, it was found that the mean left ventricular ejection fraction in the MI group (39.10 ± 6.144 %) was statistically significantly lower than in the control group (60.33 ± 4.759 %), (p < 0.001).

The mean left ventricle diastolic diameter in the MI group (5.26 ± 0.637cm) was statistically significantly higher than in the control group (4.62 ± 0.582 cm), (p < 0.001).

The mean left ventricle systolic diameter in the MI group (3.85 ± 0.743 cm) was statistically significantly higher than in the control group (3.14 ± 0.636 cm), (p < 0.001).

The mean interventricular septal thickness in the MI group (12.11 ± 2.757 cm) was statistically significantly higher than in the control group (9.77 ± 1.594 cm), (p= 0.014).

The mean posterior wall thickness in the MI group (13.54 ± 3.838 cm) was statistically significantly higher than in the control group (10.44 ± 2.523 cm), (p < 0.001).

Table 4: Echocardiographic assessment of left ventricle in the studied groups.

	MI group (n= 30)	Control group (n= 30)	95% CI	P
Left ventricular ejection fraction (%)	39.10 ± 6.144	60.33 ± 4.759	- 24, - 18	**< 0.001**
Left ventricle diastolic diameter (cm)	5.26 ± 0.637	4.62 ± 0.582	0.3, 0.9	**< 0.001**
Left ventricle systolic diameter (cm)	3.85 ± 0.743	3.14 ± 0.636	0.4, 1.1	**< 0.001**
Interventricular septal thickness (mm)	12.11 ± 2.757	9.77 ± 1.594	1.2, 3.5	**< 0.001**
Posterior wall thickness (mm)	13.54 ± 3.838	10.44 ± 2.523	1.4, 4.8	**< 0.001**

Data is expressed as mean and standard deviation. 95% CI: 95% confidence interval of the mean difference between both groups. P is significant when < 0.05.

Table 5 demonstrates that left ventricle diastolic diameter (r=0.467; p< 0.001), left ventricle systolic diameter (r=0.465; p< 0.001), interventricular septal thickness (r=0.467; p< 0.001), and posterior wall thickness (r=0.436; p< 0.001), were statistically significantly positively correlated with occurrence of MI. While left ventricular ejection fraction (r= - 0.891; p< 0.001) was statistically significantly negatively correlated with occurrence of MI.

Table 5: Correlation between occurrence of MI and left ventricle measurements in the current study.

	Correlation coefficient	P
Left ventricular ejection fraction (%)	-0.891	**< 0.001**
Left ventricle diastolic diameter (mm)	0.467	**< 0.001**
Left ventricle systolic diameter (mm)	0.465	**< 0.001**
Interventricular septal thickness (mm)	0.467	**< 0.001**
Posterior wall thickness (mm)	0.436	**< 0.001**
P is significant when < 0.05.		

4. Discussion:

The right and left ventricle of heart are intimately connected by anatomical and functional links. Hence, acute changes in cardiac geometry and function can modify the performance and physiology of both sides of the heart, influencing each other. Recently, the right heart function has become a topic of greater interest, in contrast with the LV that has always been the most important clinically [(8)].

Therefore, this observational case control study was carried out to assess the left ventricular function in patient with Ant. MI at Emergency Department in Suez Canal University hospital and to determine of the incidence of RT ventricular dysfunction in anterior MI patients.

Our study results have revealed that MI group had statistically significant higher medical history of HTN (p=0.001), DM (p=0.005), IHD (p< 0.001), smoking (p< 0.001), than the control group, the mean pulse of the MI group was (90.60 ± 11.941 BPM) statistically significantly higher than in control group (82.60 ± 8.712 BPM), (p= 0.004). The mean MAP of the MI group was (90.60 ± 8.633 mmHg), while in control group it was (90.77 ± 7.224 mmHg), with no statistically significant difference between the two groups regarding MAP (p= 0.936).

Consistent with prior studies, patients with LV dysfunction in the present study more frequently had co-existent clinical comorbidities and adverse angiographic characteristics. Many of these, such as advanced age, prior MI, female sex, presentation in Killip class 3 or 4, left anterior descending artery involvement, and an occluded infarct vessel at baseline, have also been associated with increased mortality [(9) (10–12)].

Mean Creatine kinase- MB (p < 0.001) and Troponin (p < 0.001) of the MI group were statistically significantly higher than in control group. Mean RIMP in the MI group (0.50 ± 0.081) was statistically significantly higher than in the control group. Mean TAPSE (1.76 ± 0.391 cm), fractional area change (32.34 ± 3.625 %), and DTI-Derived tricuspid Lateral Annular Systolic Velocity (11.091 ± 2.0334 cm/s) in MI group were statistically significantly lower than in the control group. Mean right ventricle strain in the MI group (-16.47 ± 3.246) was statistically significantly higher than in the control group.

Both HORIZONS-AMI and CADILLAC studies found that decreased LVEF was not associated with increased rates of re-infarction, revascularization, or stroke. In an earlier era, LV dysfunction had previously been implicated as an independent predictor of 30-day re-infarction after primary balloon angioplasty and BMS from the Primary angioplasty in Acute Myocardial Infarction (PAMI) trials. The 30 day re-infarction rate in the present study was 1.6%, somewhat lower than in the PAMI era (2.1%); the extent to which improved pharmacotherapy, devices, and technique may be resulting in greater freedom from re-infarction and a lesser effect of LV dysfunction is unknown. Furthermore, earlier studies suggested that patients with left ventricular dysfunction after myocardial infarction had higher rates of stroke [(13)].

This may be related to the increased predisposition for LV thrombus development in patients with areas of LV akinesis or dyskinesis. In an observational analysis containing 2231 patients with LV dysfunction after an acute myocardial infarction in the Survival and Enlargement (SAVE) trial, a depressed LV ejection fraction was an independent predictor of stroke events during the 5-year follow-up period. Unlike earlier reports, our study did not detect any difference in stroke rates between patients with and without LV dysfunction [(14)].

Prior studies have shown that a strong association exists between bleeding complications, blood transfusions, and increased mortality in patients with acute coronary syndromes and in those undergoing PCI [(15)]. A novel finding of the present study is that patients with severely reduced baseline LVEF had increased rates of non-CABG related major bleeding and blood transfusions, even after adjusting for other comorbidities such as advanced age and female sex which have also been associated with bleeding. While the causes of increased bleeding in patients with reduced systolic LV function are not known, the increased rate of major haemorrhagic complications and transfusions may be contributing to their poor survival in these patients [(4)].

In this study, the mean left ventricle diastolic diameter (5.26 ± 0.637cm) and left ventricle systolic diameter (3.85 ± 0.743 cm) in the MI group were statistically significantly higher than in the control group. The mean interventricular septal thickness (12.11 ± 2.757 mm) and posterior wall thickness (13.54 ± 3.838 mm) in the MI group were statistically significantly higher than in the control group.

Another study investigated global LV strain using CMR-derived feature tracking analysis for the first time in TSTEMI patients and assessed these results within the range of MI types. The TSTEMI patients presented distinctly more favourable global LV strain values than STEMI patients in all myocardial fibre directions (longitudinal, circumferential, and radial). These results indicate that TSTEMI patients suffer less LV functional damage than STEMI patients also on the myocardium fibre contraction patterns. Moreover, although LV ejection fraction was comparable between TSTEMI and NSTEMI patients, the global LV circumferential, radial, and longitudinal strain values appeared to be less impaired in TSTEMI patients than NSTEMI patients. These results may qualify the advanced role of full LV strain analysis to determine the actual extent of functional damage in the setting of an acute myocardial injury, despite preserved LV ejection fraction. Future research is needed to test whether these differences in global LV strain across MI types relate to long-term clinical outcome [(6)].

Limitations of our study include small study population and many exclusion criteria. Finally, we were not able to follow-up patients after discharge to assess the long-term effects and improvement.

5. Conclusions:

Coronary artery disease prevalence has not decreased for decades. Modifying the risk factors is the mainstay for reducing the risk of CAD. Primary clinicians should educate patients about the likelihood of CAD associated with these risk factors. Anterior MI, like any other MI, benefits from early intervention and optimal medical therapy after reperfusion. Hospital teams involving emergency clinicians, hospitalists, cardiologists, and emergency and intensive care unit (ICU) nurses can work together to provide early intervention and reduce the time from medical contact to PCI. Referral to cardiac rehabilitation and timely communication with the primary clinician at the time of discharge helps to close the loop and ensures the patient gets appropriate care after a significant cardiovascular event.

Educational campaigns must be launched to increase patient awareness of the importance of seeking medical advice promptly if chest pain occurs.

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