Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL11, ISSUE 04, 2020

Predictive Value of Serum Galectin-3 Level for Cardiac Remodeling in Patients Undergoing Primary Percutaneous Coronary Intervention

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Article History: **Received:** 4-11-2020 **Revised:** 19-11-2020 **Accepted**: **5**-12-2020

ABSTRACT

Acute myocardial infarction (AMI) is still a progressive disorder characterized by high morbidity and mortality. The circulating level of galectin-3 has emerged as a novel informative biomarker on the prediction of fibrosis, cardiac dysfunction, cardiac remodeling and the development and progression of heart failure. Objective: The aim of this study was to verify if serum galectin-3 level on hospital admission can predict myocardial remodeling in patients with STEMI undergoing primary PCI or not. Subjects and methods: We enrolled one hundred patients admitted to Zagazig university hospital, Egypt who underwent primary PCI for acute STEMI from April 2020 to June 2020 to study the predictive value of Galectin-3 on LV remodeling after AMI. Estimation of serum Galectin-3 at admission day and after 3 months of PPCI, along with echocardiographic indices of myocardial remodeling was done at admission day and after 3 months of PPCI. We retrogradely divided the patients into two groups in a case-control fashion according to occurrence of remodeling which was defined as dilatation of LV, decreased ejection fraction (EF) less than 50%, thinning of infarcted area and compensatory thickening of healthy area. So, the groups can be as follows: group I: Non-remodelers (n=44) and group II: Remodelers (n=56). Results: Regarding demographic data and clinical characteristics, there was no statistically significant difference between both groups. There was no statistically significant difference between both groups regarding MI territory (thus both groups were well-matched). There was statistically non-significant difference between both groups regarding baseline TIMI flow (p: 0.9), but post primary PCI, the remodelers group had significantly worse TIMI flow (p: 0.04). Both baseline and 3month serum Galectin level had statistically significant negative correlation with EF (P<0.001) and positive correlation with both LVESV, LVEDV (P<0.001). Relying on receiver operating characteristics (ROC) curve, we concluded that serum Galectin-3 level at baseline is an independent predictor of remodeling occurrence (P<0.0001) with an area under the curve = 0.673 and cutoff value >15.8 ng/ml. Patients with LV systolic dysfunction after 3 months had higher baseline galectin-3 when compared to patients with preserved ejection fraction. Conclusion: Galectin-3 has been associated with fibrosis development and cardiac remodeling hallmarks of HF. We observed that baseline galectin-3 was independently associated with the development of LV dysfunction. We concluded that baseline galectin-3 has strong association with progressive cardiac remodeling after MI.

Keywords: Galectin-3, Remodeling, Primary PC***I.***

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Introduction

Acute myocardial infarction (AMI) continues to be a progressive illness with substantial morbidity and mortality despite cutting-edge treatment, indicating that significant pathogenic pathways are still alive and unaffected by current therapy **[1,2]**. Congestive heart failure (CHF) may indicate a poor prognostic prognosis in patients with decompensated cardiovascular illnesses, according to earlier clinical research **[3]**.

The biomarkers and CHF have been linked in numerous studies to both short- and long-term prognostic outcomes in AMI patients **[4]**. Among these biomarkers, the level of galectin-3 in the blood has become a new, useful indicator for fibrosis prediction, cardiac dysfunction , cardiac remodeling, and the onset and progression of heart failure **[5-8]**.

The impact of the circulating amount of galectin-3 on the prognosis outcome of STEMI patients after primary PCI has not been fully studied, but it has been noted that galectin-3 is a good signal for identifying CHF patients at high risk of readmission or death **[8]**. A family of lectins known as galectins has been found to bind -galactosides **[9]**. Leukocytes, mast cells, and a variety of organ tissues have all shown to express galectin-3 **[10]**.

Patients with decompensated CHF have been found to overexpress galectin-3 **[6]**. Galectin-3 has also been linked to the stimulation of myofibroblasts and the subsequent development of hepatic fibrosis and renal fibrosis **[5,11]**. Galectin-3 may also have a significant impact on the clinical course of AMI's inflammatory response, fibrosis and scarring, cardiac remodeling, and heart failure **[12]**. The aim of the current study was to evaluate the relationship between circulating levels of galectin-3 and echocardiographic measures of myocardial remodeling in order to confirm the hypothesis that elevated levels of galectin-3 are a useful biomarker for predicting ventricular remodeling in STEMI patients undergoing primary PCI.

Patients and methods:

The study included 100 patients presented by acute STEMI undergoing primary PCI admitted to Zagazig University Hospitals, during the period from April 2020 to June 2020 to study the predictive value of Galectin-3 on LV remodeling after AMI. Estimation of serum Galectin-3 at admission day and after 3 months of PPCI, along with echocardiographic indices of myocardial remodeling was done at admission day and after 3 months of PPCI.

Inclusion criteria:

Acute STEMI; According to the Joint European Society of Cardiology/American College of Cardiology Committee's consensus document for the redefining of myocardial infarction **[13]**, STEMI was defined as follows: Ischemic symptoms in conjunction with a rise in a biochemical marker of myocardial necrosis (CK or troponin) within the local reference range and new or suspected new ST segment elevation at the J point in two or more contiguous leads with the cut-off points of 0.2 mV in leads V1, V2, or V3 and 0.1 mV in other leads. All patients were successfully revascularized by primary percutaneous coronary intervention (PPCI).

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Exclusion criteria:

We excluded from our study patients with previous MI, passed time STEMI (patients presented by symptoms > 24 hours), non-STEMI, unstable angina, congestive heart failure, patients with renal failure and liver cell failure. Also, patients with failed reperfusion or planned for CABG were excluded from our study.

Grouping of patients:

We retrograde divided patients into two groups in a case-control fashion according to occurrence of remodeling which was defined as dilatation of LV, decreased ejection fraction (EF) less than 50%, thinning of infarcted area and compensatory thickening of healthy area **[14]**. So, the groups can be as follows:

- Group I: Non-remodelers (n=44).
- Group II: Remodelers (n=56).

All patients were subjected to:

1- Complete history taking.
2- Full general and local examination.
3- Laboratory investigation including serum creatinine, Galectin 3, cardiac enzyme, random blood sugar and serially estimated serum Galectin3 at the 1st day and 3rd month of admission.
4- Twelve Lead ECG: on presentation and at 60 minutes after thrombolysis or immediately after primary PCI. Twenty milliseconds after the J-point, the ST-segment elevation measured. Infarcted leads had their sum of ST-segment elevations (sum STE) assessed. The percentage of total ST-segment reduction between pre- and post-reperfusion served as an indicator of ST resolution (STR).
5- Echocardiography and assessment of indices for myocardial remodeling: LV systolic function was evaluated using a General Electric System Vivid-9 machine with a (2.5-5) MHZ probe on admission and three months thereafter performing PCI. In both apical two and four chamber views, LV systolic function was evaluated by measuring ejection fraction (EF) using the biplane Simpson's method **[15]**. We relied on simple parameters of remodeling which was defined as dilatation of LV measured by left ventricular end diastolic (LVEDV) and systolic volumes (LVESV), decreased ejection fraction (EF) less than 50%, thinning of infarcted area and compensatory thickening of healthy area **[14]**.
6- Angiographic assessment immediately by means of primary PCI.

Statistical Analysis

Microsoft Excel was used to gather, enter, and analyze the data. The Statistical Package for the Social Sciences (SPSS) version 16 software was then used to import the data for analysis. The following tests were performed to determine whether variations in representations of qualitative and quantitative data were statistically significant: To evaluate the significance of the

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difference between the two quantitative groups, an independent (T) test was performed. The Chi Square Test was employed to examine the comparison and relationship between two qualitative variables. Mann– Whitney U test was used to compare differences between two independent groups when the dependent variable is either ordinal or continuous, but not normally distributed. Correlation between serum Galectin level and echocardiographic parameters was performed using (r) Pearson Correlation Coefficient which is significant at the 0.01 level (2-tailed). Predictive value of serum Galectin-3 level for cardiac remodeling was assessed using a Receiver Operating Characteristic (ROC) curve. For two-tailed tests, a P-value of 0.05 or lower was regarded as statistically significant, and 0.001 was regarded as highly significant.

Results

Our study was performed during the period from April 2020 to June 2020 in cardiology department, Zagazig University. Our study included 100 patients who were admitted to the coronary care unit with chest pain and provisional diagnosis of acute STEMI, all were proved to have acute STEMI based on electrocardiographic and biochemical data. All patients underwent primary PCI "PPCI". Estimation of serum Galectin-3 level at admission day and after 3 months of PPCI, along with echocardiographic indices of myocardial remodeling was done at admission day and after 3 months of PPCI.

We retrogradely divided patients into two groups in a case-control fashion according to occurrence of remodeling which was defined as dilatation of LV, decreased ejection fraction (EF) less than 50%, thinning of infarcted area and compensatory thickening of healthy area [14]. So, the groups can be as follows:

- **Group I**: Non-remodelers (n=44), with age ranged from 41 to 63 years with mean value of 56.32±8.99 years old, Number of females was 22 (50%), while number of males was 22 (50%).
- **Group II**: Remodelers (n=56), with age ranged from 45 to 72 years with mean value of 58.27±7.07, Number of females was 20 (35.7%), while number of males was 36 (64.3%).

Regarding demographic data there was no statistically significant difference between both groups regarding age (t=0.41, P=0.686), body mass index (BMI) (t=-1.31, P=0.197), gender ($\chi2$=1.03, P=0.31), smoking ($\chi2$=0.019,P=0.890), hypertension ($\chi2$=0.010, P=0.919), dyslipidemia ($\chi2$=0.045, P= 0.833), diabetes mellitus ($\chi2$=0.018, P=0.870) and family history of coronary artery disease (CAD) ($\chi2$=1.672, P=0.196) **(Table 1)**.

Regarding the clinical characteristics, there was no statistically significant difference between both groups regarding heart rate (t=0.52, P=0.609), systolic and diastolic blood pressure (t=0.99, P=0.328) (t=0.51, P=0.611) respectively **(Table 2)**.

There was no statistically significant difference between both groups regarding MI territory (thus both groups were well-matched) **(Table 3)**.

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Regarding echocardiographic parameters, there was statistically significant difference between both groups regarding LVEDV both on admission and on 3 month follow-up (t=4.76, P < 0.0001), (t=3.71, P = 0.0005) respectively. In comparison of baseline to 3 month LVEDV, Statistical analysis in both groups showed non-significant difference (P= 0.111, P =0.214) respectively. Similar findings were revealed with LVESV, as there was statistically significant difference between both groups both on admission and on 3 month follow-up (t=6.84, P = 0.006), (t=5.97, P < 0.0001) respectively. In comparison of baseline to 3 month LVESV, Statistical analysis in both groups showed non-significant difference (P= 0.310, P =0.432) respectively. Regarding EF, there was statistically significant difference between both groups both on admission and on 3 month follow-up (t=5.85, P < 0.0001), (t=6.23, P < 0.0001) respectively. In comparison of baseline to 3 month EF, Statistical analysis in both groups showed non-significant difference (P= 0.221, P = 0.312) respectively **(Table 4)**.

Table (1): Comparison of demographic characteristics between the two studied groups:

		Group I (n=44)	Group II (n=56)	t-value	P-value
Age (year)		**56.32±8.99 (41-63)**	**58.27±7.07 (45-72)**	**0.41^{NS}**	**0.686**
BMI (kg/m2)		**30.09±2.22 (27-35)**	**30.5±3.16 (25-37)**	**-1.31 ^{NS}**	**0.197**
Gender	**Female**	**22(50.0%)**	**20(35.7%)**	**χ^2=1.03 ^{NS}**	**0.31**
	Male	**22(50.0%)**	**36(64.3%)**		
Smoking no. (%)		**26 (59.1%)**	**32 (57.1%)**	**0.019 ^{NS}**	**0.890**
Hypertension no. (%)		**32 (72.7%)**	**40 (71.4%)**	**0.010 ^{NS}**	**0.919**
Dyslipidemia no. (%)		**16 (36.4%)**	**22 (39.3%)**	**0.045 ^{NS}**	**0.833**
Diabetes mellitus no. (%)		**22 (50%)**	**30 (51.7%)**	**0.018 ^{NS}**	**0.870**
Family history of CAD no. (%)		**14 (31.8%)**	**28 (50.0%)**	**1.672 ^{NS}**	**0.196**

NS: indicate non-significant difference

Table (2): Comparison of clinical characteristics between the two studied groups:

	Group I (n=44)	Group II (n=56)	t- value	P-value
Heart rate (HR)	**75.86±13.09 (55-100)**	**80.93±13.96 (60-110)**	**0.52 ^{NS}**	**0.609**
Systolic blood pressure (SBP) (mmHg)	**133.57±25.42 (90-180)**	**140.45±23.19 (90-190)**	**0.99 ^{NS}**	**0.328**
Diastolic blood pressure (DBP) (mmHg)	**81.79±12.78 (60-100)**	**83.64±12.55 (60-110)**	**0.51 ^{NS}**	**0.611**

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NS: indicate non-significant difference

Table (3): Comparison of infarction territory by ECG.

	Group I (n=44)		Group II (n=56)		χ^2 value	P-value
	No.	%	No.	%		
Anterior Wall	24	54.5	44	78.6	3.27^{NS}	0.071
Non-anterior Wall	20	45.5	12	21.4		

NS: indicate non-significant difference

Table (4): Comparison of echocardiographic indices of myocardial remodeling in both groups, measured at admission and 3 months post PPCI.

		Group I (n=44)	Group II (n=56)	t- value	P-value
LVEDV (mL)	Baseline	105.25±6.96	115.91±8.5	4.76^{**}	< 0.0001
	3 month	109.71±21.69	125.77±6.6	3.71^{**}	0.0005
P-value		0.111	0.214	-	-
LVESV (mL)	Baseline	44.59±12.11	65.18±9.19	6.84^{**}	0.006
	3 month	45.5±10.59	66.46±13.51	5.97^{**}	< 0.0001
P-value		0.310	0.432	-	-
EF (%)	Baseline	58.36±8.43	43.14±9.64	5.85^{**}	< 0.0001
	3 month	59.77±7.2	46.75±7.45	6.23^{**}	< 0.0001
P-value		0.221	0.312	-	-

*t: independent samples t-test, *: indicate significant difference (P<0.05),**: indicate highly significant difference (P<0.01), LVEDV: left ventricular end diastolic volume, LVESV: left ventricular end systolic volume, EF: ejection fraction.*

Regarding serum Galectin-3 level, there was statistically significant difference between both groups both on admission and on 3 month follow-up (U=121.0, P=0.0003), (U=241.00, P=0.013) respectively. In comparison of baseline to 3 months Galectin-3level, statistical analysis in both groups showed significant difference (P=0.003, P<0.0001) respectively **(Table 5, Figure 1,2)**.

There was statistically non-significant difference between both groups regarding baseline TIMI flow (p: 0.9), but post primary PCI, the remodelers group had significantly worse TIMI flow (p: 0.04) **(Table 6)**. LAD was the culprit vessel in the remodelers compared to non-remodellers (p: 0.021) **(Table 7)**.

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Both baseline and 3month serum Galectin level had statistically significant negative correlation with EF (P< 0.001) and positive correlation with both LVESV, LVEDV (P< 0.001) **(Table 8)**.

Relying on receiver operating characteristics (ROC) curve, we concluded that serum Galectin-3 level at baseline and on 3 month follow-up is an independent predictor of remodeling occurrence (P<0.0001) with an area under the curve = 0.673 and cutoff value >15.8 ng/ml for the baseline Galectin-3 level and with an area under the curve (AUC) of 0.888, p <0.0001 and a cutoff value = >18.7 ng/ml for the 3month Galectin level **(Table 9, Figure 3,4)**.

Table (5): Comparison of baseline and 3 months follow-up Galectin3 levels among the studied groups

	Group I (n=44)	Group II (n=56)	U-Value	P-value
Galectin-3 Baseline Median [IQR]	**13.6 [12.8-14.9]**	**15.65 [14.85-17.5]**	**121.0****	**0.0003**
Galectin-3 3Months Median [IQR]	**15.95 [15.4-17]**	**19.85 [16.75-20.9]**	**241.0***	**0.013**
P-value	**0.003**	**< 0.0001**	-	-

*U: Mann– Whitney U test respectively, IQR; interquartile range (25th to 75th percentile range), *: indicate significant difference (P<0.05), **: indicate highly significant difference (P<0.01)*

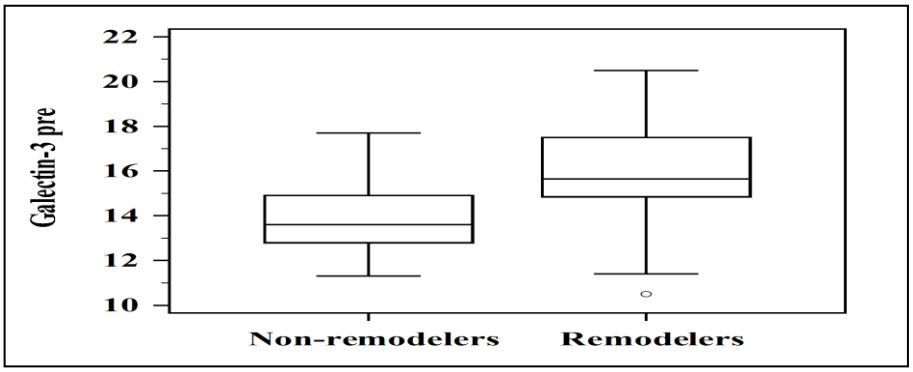

Figure (1): Box and whiskers plot showed baseline Galectin-3 levels

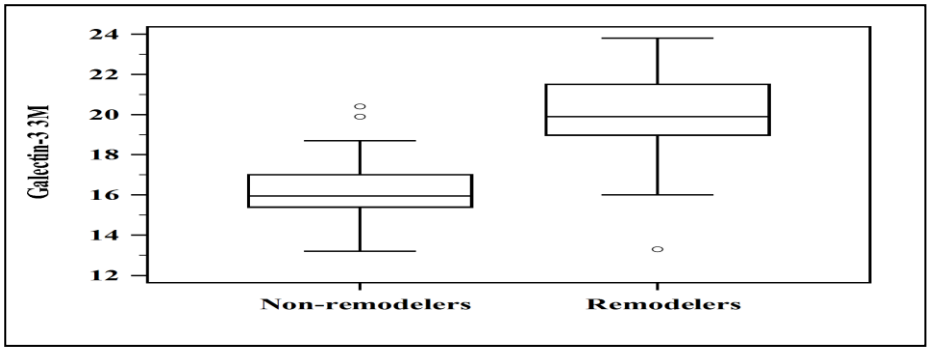

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Figure (2): Box and whiskers plot showed 3-month Galectin-3 levels.

Table (6): Comparison of baseline and post PPCI TIMI flow between the two studied groups

	Baseline TIMI flow						Post PPCI TIMI flow					
TIMI flow	Group I (n=44)		Group II (n=56)		χ^2 value	P-value	Group I (n=44)		Group II (n=56)		P-value	
	No	%	No	%			No	%	No	%		
0	34	77.3	44	78.6	0.012^{NS}	0.912	0	0.0%	0	0.0%	0.04*	
1	10	22.7	12	21.4			0	0.0%	0	0.0%		
2	0	0.0%	0	0.0%			0	0.0%	6	10.7%		
3	0	0.0%	0	0.0%			44	100.%	50	89.3%		

*NS: indicate non-significant difference, *: indicate significant difference (P<0.05)*

Table (7): Comparison of Culprit vessel between the 2 studied groups

	Group I (n=44)		Group II (n=56)		χ^2 value	P-value
	No	%	No	%		
LAD (n=50)	18	36	32	64	3.42^{*}	0.021*
LCX (n=18)	6	12	12	24	1.96^{**}	< 0.0001**
RCA (n=32)	20	40	12	24	2.76^{**}	< 0.0001**

**: indicate significant difference (P<0.05), **: indicate highly significant difference (P<0.01)*

Table (8): Correlation among baseline, 3month Galectin-3 level and LVEF, LVESV and LVEDV in the studied groups

	Baseline Galectin-3 level				3 month Galectin-3 level			
	Baseline		3 months		Baseline		3 months	
	r	P-value	r	P-value	r	P-value	r	P-value
LVEF	-0.244^{**}	<0.001	-0.319^{**}	<0.001	-0.229^{**}	<0.001	-0.342^{**}	<0.001

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LVESV	**0.352****	**0.008**	**0.255****	**<0.001**	**0.279****	**0.005**	**0.217****	**<0.001**
LVEDV	**0.258****	**<0.001**	**0.261****	**0.004**	**0.254****	**0.001**	**0.301****	**0.006**

*r: Pearson Correlation Coefficient, ** Correlation is significant at the 0.01 level (2-tailed).*

Table (9): Prognostic accuracy measures of baseline and 3months Galectin -3 to predict ventricular remodeling using EF as gold standard.

Prognostic Accuracy	Baseline	3 Month
Sensitivity% (95% CI)	73.68 (48.8 - 90.9)	82.61 (61.2 - 95.0)
Specificity% (95% CI)	64.52 (45.4 - 80.8)	90.91 (70.8 - 98.9)
PPV (95% CI)	56.0 (34.9 - 75.6)	90.5 (69.6 - 98.8)
NPV (95% CI)	80.0 (59.3 - 93.2)	83.3 (62.6 - 95.3)

CI: Confidence interval, PPV: positive Predictive value, NPV: Negative Predictive value

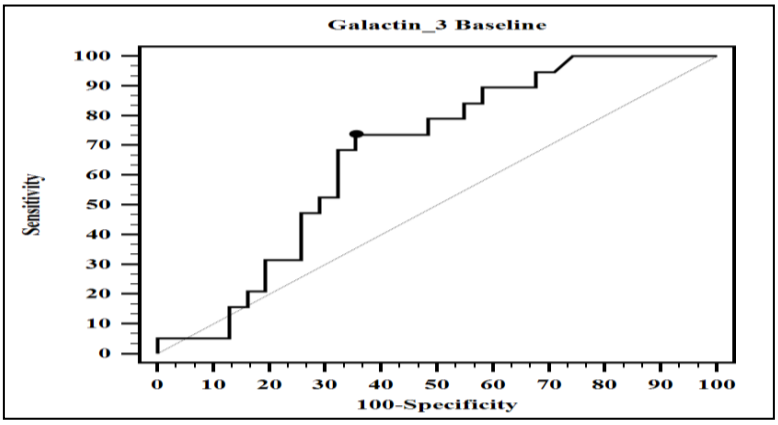

Figure (3): ROC analysis of baseline Galectin -3.

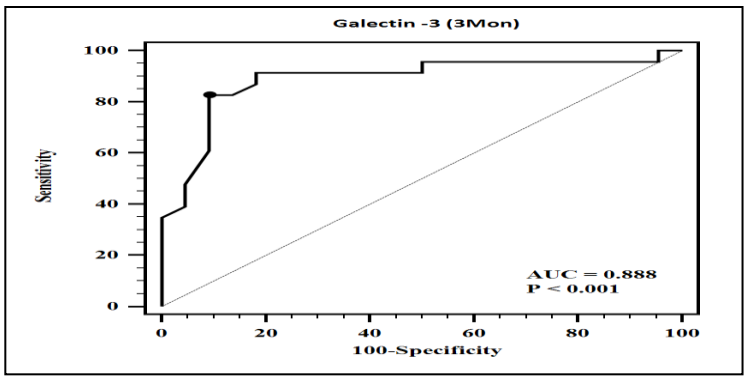

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Figure (4): ROC analysis of 3 months Galectin -3.

Discussion

One of the most significant factors contributing to heart failure (HF) is acute myocardial infarction (MI) **[16]**. More patients are surviving MI as a result of better therapy, but as a result, the incidence of HF is increasing **[17]**. The decrease of cardiac function and emergence of heart failure following MI are significantly influenced by cardiac remodeling **[16]**. Identification of individuals with poor prognoses, risk factors for unfavorable cardiac remodeling and the development of HF, and those whose therapy needs to be escalated early is crucial. Biomarkers may be employed in the risk stratification for the onset of heart failure **[18]**. Creatine kinase (CK) and troponin, biomarkers that indicate myocardial injury, can be used to quantify infarct size early after MI, but their sensitivity to identify other cardiac remodeling processes is constrained **[19]**. In cardiac remodeling following MI, fibrosis is crucial **[16]**. Emerging fibrotic biomarker galectin-3 is thought to play a causative role in the onset of heart failure **[14]**.

During cardiac stress, macrophages generate galectin-3, a lectin that binds beta-galactosidase and stimulates fibroblasts **[8]**. Galectin-3 plays a significant impact in (cardiac) fibrosis in addition to its activities in inflammation and cellular adhesion **[20]**. Galectin-3 has been demonstrated to reliably predict outcomes in HF patients, is released into the bloodstream, and can be tested. Galectin-3 has recently been recommended by the AHA for use in heart failure risk stratification, however there are limited data on its prognostic significance in the post-MI situation **[21,22]**.

Our study included 100 patients who were admitted to the coronary care unit with chest pain and provisional diagnosis of acute STEMI, all were proved to have acute STEMI based on electrocardiographic and biochemical data. All patients had undergone primary PCI "PPCI".

Estimation of serum galectin-3 at admission day and after 3 months of PPCI, along with echocardiographic indices of myocardial remodeling was done at admission day and after 3 months of PPCI.

In our study, the demographic characters and history of group I and Group II subjects revealed that there was no statistically significant difference between the two studied groups regarding age, gender, BMI, Smoking, Hypertension, Dyslipidemia and FH.

In accordance to these results, **Van der Velde et al.[14]** and **Lok et al.[20]** found that the descriptive characteristics of participants showed no statistically significant difference. On the other hand, in a study of **Tsai et al. [1]**, found that patients of both groups showed statistically significantly difference regarding demographic parameters. As we studied a smaller population (N = 100) than **Tsai et al. [1]** (N = 196) which increase the variation in demographic parameters.

For HR, SBP and DBP, our study showed non-significant differences between the two studied groups, this results agreed with that found by both of **Tsai et al. [1]** and **Lok et al.[20].**

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In our study, infarction location by ECG (Anterior/Non-anterior wall) showed non-significant difference between patients of the studied groups. In accordance to these results, **Tsai et al. [1]** found that no statistically significant difference regarding infarction territory by ECG.

This study demonstrated that, there were significant differences between the two studied groups regarding LVEDV (mL) LVESV (mL) and EF (%) measured at admission and three-month post PPCI. In accordance to these results, **Van der Velde et al.[14]** found that all of these differences were statistically significant except for LVEDV which showed non-significant difference, however, this may explained by the following; they studied a larger population (N = 380) cohort than our study (N = 100). Additionally, they used cardiac MRI for measuring LV parameters, while we used echocardiography and finally he measured LV parameters at 4th month, while we measured it at 3rd month. **Tsai et al. [1]** found that LVEF (%) showed signficant difference, which agreed our study.

Our study demonstrated that initial TIMI flow showed non-significant difference in both groups. This agreed with **Tsai et al. [1]** showed non-significant difference about initial TIMI flow. In contrast to our findings, **Van der Velde et al.[14]** revealed statistical significant difference considering initial TIMI flow. This may be explained by that **Van der Velde et al.[14]** grouped his patients according to LVEF only, while we depend on the following remodeling criteria (Dilatation of LV, Decrease EF < 50%, Thinning of infarcted area, Compensatory thickening of healthy area), Also LVEF was used for grouping his patients was measured at 4 months after acute MI. **Van der Velde et al.[14]** studied a larger population (N = 380) cohort than our study (N = 100).

There was statistically non-significant difference between both groups regarding baseline TIMI flow (p: 0.9), but post primary PCI, the remodelers group had significantly worse TIMI flow (p: 0.04) with more LAD prevalence as a culprit vessel which supplies large myocardial territory explaining that this group had more LV remodeling and worse LV function. In accordance to our findings, **Van der Velde et al.[14]** and revealed also statistical significant difference considering serum Galectin-3 levels at baseline and three month post PCI. **Lok et al.[20]** found significant difference regarding baseline galactin-3 when he depended on the change of LEDV as a crieteria for grouping his patients.

In contrast to our findings, **Lok et al.[20]** found no-significant differences regarding 3 months and 12 months galactin-3 , this may explained by that Lok et al used Baseline quartiles LVEDV for grouping his patients while we used remodeling criteria. In addition, **Lok et al.[20]** studied a larger population (N = 240) cohort than our study (N = 100), finally his inclusion criteria was only patients with HF (EF<45%), while this was not one of our inclusion criteria.

Our results revealed that, baseline and 3-months galectin-3 was negatively correlated with LVEF at admission and at 3-month. While it was positively correlated with Baseline and 3-months LVESV and LVEDV. In accordance to our findings, **Tsai et al. [1]** found that serum Galectin-3 levels at baseline and three month showed significant negative correlation to LVEF. But he didn't study the correlation of Galectin-3 to LVESV and LVEDV.

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The current study supported **Van der Velde et al.[14]** by confirming that high galectin-3 levels were linked to reduced LVEF at a 3-month follow-up. However, **Van der Velde et al.[14]** found that baseline galectin-3 had no correlation with baseline echocardiographic measurements (LVESV, LVEDV and LVEF). As an explanation, consider the following: Prior to enrolling patients, **Van der Velde et al.[14]** only included those with LV dysfunction (LVEF 40% on echocardiography) and they did not include patients with substantially maintained LVEF, However, we did not use LV dysfunction as an enrollment criterion in our study.

Additionally, in the study by **Van der Velde et al.[14]** revealed blood was taken 46 hours (on average) after enrollment, echocardiography was done 97 hours later, and a second echocardiogram was done 24 weeks (6 months) afterwards. Immediately after hospital admission, we conducted our baseline sampling. And an echocardiogram was done three months later.

After MI, we observed that galectin-3 levels marginally increased. In patients with cardiac remodeling, galectin-3 continues to play a role. Galectin-3 was among the most stable biomarkers assessed in patients after PCI following MI, this finding supported by **Kruk et al. [23]**. This could support the notion that remodeling occurs earlier at the cellular level before gross remodeling occurs high-lightening the value of early reperfusion.

Galectin-3 may be increased to create stiffer collagen in an effort to stop LV dilatation and maintain LV ejection fraction, according to some speculation. Galectin-3 levels that are consistently high at baseline are still a bad sign. Strong interest has been shown in biomarker-targeted treatment. It is intriguing to consider the possibility that tailored therapy intended to reduce galectin-3 can enhance patient prognosis following acute MI. Galectin-3 pharmacological suppression and genetic disruption have been proven to reduce myocardial fibrosis in experimental models **[24]**. According to other experimental evidence, mineralo-corticoid agonist (MRA) therapy after MI significantly decreased galectin-3 expression in the infarcted myocardium and increased LVEF **[24]**.

Study limitations

Small sample size, single center study, short-term follow-up and not using speckle tracking technique as a measure of cardiac remodeling were the main limitations of our study.

Conclusion

The hallmarks of HF, the fibrosis and cardiac remodeling, have been linked to galectin-3. Early and late remodeling after MI depends heavily on fibrosis and the creation of scar tissue. Galectin-3 may be involved in the pathogenesis of cardiac remodeling following acute MI, according to our hypothesis. We found that the development of LV dysfunction was independently correlated with baseline galectin-3. As a result of our findings, we hypothesize that increased galectin-3 levels in participants at the time of MI may predispose to faster tissue

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damage. Baseline galectin-3 exhibits a substantial correlation with progressive cardiac remodeling after MI. MRA treatment might be used to reduce galectin-3 levels.

Recommendations

We recommend measuring serum Galectin-3 level on admission for primary PCI candidate to predict short-term myocardial remodeling.

- **Conflict of Interest: No conflict of interest to disclose.**
- **Financial Disclosures: No financial interests to disclose.**

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