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Impact of Admission Blood Glucose Level on in-Hospital Outcome of Patients with Recent ST Elevation Myocardial Infarction Treated by Primary Percutaneous Coronary Intervention

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ABSTRACT

Background: It has been shown that a higher admission blood glucose level (ABGL) relates to a bigger infarct size in acute myocardial infarction (AMI). **Objective:** The objective of this research is to assess the effect of ABGL on the occurrence of major adverse cardiovascular events (MACEs) during hospitalization in patients who have recently had ST elevation myocardial infarction (STEMI) and have undergone Primary percutaneous coronary intervention (PPCI). **Methods:** This research was carried out on 400 consecutive patients, aged older than 18 years old, both sexes, with clinical criteria of STEMI and treated with PPCI and both patients diabetic and non-diabetic were involved. Patients were categorized into 4 groups regarding to random blood glucose level then further subdivided into 2 groups out of 400 patients; 84 patients developed MACE (MACE group) and 316 patients not developed MACE (Non-MACE group). **Results:** The presence of elevated blood glucose levels at admission, even in the absence of a diagnosis of diabetes mellitus, is a notable indicator of a negative prognosis. Elevated entry blood glucose levels have been shown to be positively correlated with a higher incidence of left ventricular (LV) systolic dysfunction. Patients in the research had a higher incidence of recurrent anginal episodes, arrhythmias, and cardiogenic shock. **Conclusions:** Patients exhibiting excessive blood glucose levels are at a heightened risk of having several adverse cardiovascular outcomes, including TIMI 0 "no-reflow," in-hospital mortality, cardiogenic shock, ventricular arrhythmia, acute heart failure, and reinfarction.

Keywords: Blood Glucose, Recent ST Elevation, Myocardial Infarction, PCI

1. Introduction

Previous studies have reported on the relation between larger infarct size and increased admission blood glucose level (ABGL) in cases of acute myocardial infarction (AMI), as well as the presence of inflammation in acute coronary syndrome (ACS) (Timmer *et al.,* 2005; Ray *et al.,* 2007).

Numerous research has examined the potential direct influence of hyperglycemia on unfavorable outcomes among individuals with ACS, using several pathophysiological pathways. Several investigations have shown that hyperglycemia has a deleterious impact on ischemic myocardium. According to reports, the presence of acute hyperglycemia has been shown to eliminate the protective effects of ischemia preconditioning and instead facilitate the process of apoptosis (Ishihara *et al.,* 2003; Ceriello *et al.,* 2002).

The presence of acute hyperglycemia has been observed to result in a reduction in the bioavailability of nitric oxide, impairment of endothelial function, elevation in platelet aggregability, and stimulation of coagulation (Worthley *et al.,* 2007).

These alterations have the potential to induce microvascular dysfunction during the process of reperfusion and subsequently result in reduced left ventricular function after AMI (Ishihara *et al.,* 2003).

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The purpose of this research is to assess the impact of ABGL on the occurrence of MACEs during hospitalization in patients who have recently had STEMI and have undergone PPCI.

2. Patients and Methods

This research was conducted on 400 consecutive patients, aged older than 18 years old, both sexes, with clinical criteria of STEMI and treated with PPCI and both patients diabetic and none-diabetic were involved. The research was conducted under the consent of the Ethical Committee of Tanta University Hospitals, spanning from November 2021 to November 2022. The patients were gained informed written consent.

Exclusion criteria: < 18 years old, prior MI, prior CABG, malignancy, renal impairment who has creatinine clearance less than 60 mL/min/1.73 m2, hepatic impairment and blood disorder who can't tolerated longstanding dual antiplatelet.

Patients were divided into 4 groups according to random blood glucose level then further subdivided into 2 groups out of 400 patients; 84 patients developed MACE (MACE group) and 316 patients not developed MACE (Non-MACE group).

All patients had a comprehensive assessment, which included gathering detailed information on their age, gender, and medical history, particularly focusing on risk factors associated with coronary artery disease (CAD) such as diabetes mellitus, hypertension, smoking, as well as personal and familial history of CAD. For the purpose of this study, a patient was considered to have diabetes if they had a documented history of the condition or a current diagnosis of diabetes mellitus. Dyslipidemia refers to the condition where the serum total cholesterol level exceeds 200mg/dl or the triglyceride level exceeds 150mg/dl, or when the individual is currently undergoing treatment with lipid-lowering medication. The term "current smoking" refers to those who have consumed a minimum of 100 cigarettes during their lives and persist in engaging in smoking behavior. Additionally, a family history of premature coronary artery diseases is considered. A comprehensive clinical examination is conducted, which includes assessing vital signs such as heart rate, blood pressure, and respiratory rate. A general examination is performed, paying attention to factors such as height, weight, body mass index (BMI), overall appearance, decubitus, cyanosis, jaundice, and signs of heart failure. Furthermore, a local cardiac examination is conducted, focusing on abnormal pulsations, heart sounds, and murmurs. Finally, a resting 12-lead electrocardiogram is obtained. The electrocardiogram (ECG) is a diagnostic tool used in the medical field.

Baseline laboratory tests

Including serum urea and creatinine, cardiac enzymes include CK-MB and hemoglobin level-liver function test (consider elevated when became three time more than normal level) - CBC –lipid profile –electrolytes- random blood glucose (HBA1C).

Echocardiography

All studies were performed using (a GE vivid seven Cardiac ultrasound phased array system).

Two- Dimensional echocardiographic assessment by M-mode and modified Simpson method were done during admission after successful PCI.

2-D Echocardiography was done

Serum blood glucose level

The patients were classified into subgroups according to their admission blood glucose levels for the purpose of analysis. The participants were categorized into four groups according to their glucose levels: Group 1 consisted of individuals with glucose levels of 120 mg/dl or lower, Group 2 included individuals with glucose levels ranging from 121 to 200 mg/dl, Group 3 encompassed individuals with glucose levels ranging from 201 to 250 mg/dl, and Group 4 comprised individuals with glucose levels exceeding 250 mg/dl. The objective of the study was to determine the threshold value at which the occurrence of MACE increased, using a receiver operating characteristic (ROC) curve.

Primary percutaneous intervention

The primary percutaneous intervention (PCI) procedure is often used for the treatment of the infarct-related artery (IRA).

Coronary flow assessment

The examination of coronary blood flow patterns after Primary Percutaneous Coronary Intervention (PCI) will be conducted based on the following criteria:
The recording of **TIMI** flow grade was documented.

Statistical analysis

IBM Inc., located in Chicago, IL, USA, created SPSS version 25, which was used for the statistical analysis. In order to choose between parametric and nonparametric statistical testing, the distribution of the quantitative data was evaluated using the Shapiro-Wilks normality test and histograms. To compare the three groups, the parametric variables—the mean and standard deviation (SD)—were put through an analysis of variance (ANOVA). For each pair of groups, a post hoc test called the Tukey test was employed. The Kruskal-Wallis test was used to analyze the non-parametric variables, which were represented by their median and interquartile range (IQR). After then, each pair of groups was compared using a Mann-Whitney (U) test. Frequency and percentage were used to represent the categorical variables, and the Chi-square test was used to statistically analyze them. A statistically significant two-tailed P value was defined as one that was less than or equal to 0.05. Through the use of Receiver Operating Characteristic curve (ROC-curve) analysis, each test's diagnostic performance was assessed. A curve that begins in the lower left corner, extends to the upper left corner, and ends in the upper right corner is indicative of a perfect exam. The area under the curve (AUC) is used to evaluate the overall performance of the test; an AUC value of more than 50% indicates acceptable performance, and an AUC value of almost 100% suggests the best possible performance. It was determined that a two-tailed P-value of less than 0.05 to be statistically significant.

3. Results

The MACE group was notably elderly. The percentage of females in the non-MACE group was substantially higher than that of the MACE group in terms of sex. Compared to the non-MACE group, the MACE group exhibited a notably elevated mean BMI, mild mitral regurgitation incidence, and hemoglobin level. The MACE group showed significantly higher mean pulse rates, significantly lower mean systolic blood pressure (SBP) and ejection fraction values, and significantly lower diastolic blood pressure (DBP) in echocardiographic and hemodynamic outcomes. When compared to the non-MACE group, the echocardiographic results, mean end-systolic dimension (ESD), and end-diastolic dimension (EDD) measurements were considerably bigger. However, there was no significant difference in mean left atrium size between the two groups. There was no significant difference in platelet count between the two groups. The Non-MACE group had a significantly higher mean high-density lipoprotein (HDL), mean low-density lipoprotein (LDL) level, mean triglyceride, mean creatinine levels and mean urea levels compared to the MACE group. (Table 1)

The differences in MACE incidence between these groups were highly significant, with a p-value of 0.001. The Post Hoc analysis by LSD shows that the differences in MACE incidence between patients with RBG levels ≤120 mg/dl and those with RBG levels >250 mg/dl are highly significant (p-value = 0.001). In addition, the differences in MACE incidence between patients with RBG levels ≤120 mg/dl and those with RBG levels in the range of 121-200 mg/dl, and between patients with RBG levels in the range of 201-250 mg/dl and those with RBG levels >250 mg/dl, are also significant (p-value <0.05). Overall, this table provides additional information on the significant differences in MACE incidence between patients with different admission RBG levels and highlights the importance of monitoring and managing blood glucose levels in patients with cardiovascular disease. The Post Hoc analysis provides further insight into the differences between each pair of groups and can help guide clinical decision-making (Table 2).

Table 1: Comparison between non-MACE group and MACE group according to hemodynamics, demographic data, BMI on echocardiographic and admission findings, admission blood glucose level, laboratory results.

		Non-MACE No. = 316	MACE No. = 84	P-value	Sig.
Age (years)		54.71 ± 10.22	59.48 ± 8.40	0.001	HS
Gender	**Female**	72 (22.8%)	28 (33.3%)	0.047	S
	Male	244 (77.2%)	56 (66.7%)		
BMI (Kg/m2)		30.62 ± 2.75	32.14 ± 4.46	0.001	HS
SBP (mmHg)		134.30 ± 19.76	120.00 ± 28.96	0.001	HS
DBP (mmHg)		84.18 ± 11.00	78.10 ± 20.03	0.001	HS
Pulse (bpm)		82.86 ± 13.87	98.76 ± 31.42	0.001	HS
Ejection fraction (%)		45.63 ± 6.97	37.43 ± 8.16	0.001	HS
ESD (mm)		41.29 ± 7.57	47.86 ± 5.04	0.001	HS
EDD (mm)		53.16 ± 6.97	57.81 ± 5.49	0.001	HS
Left atrium (mm)		41.15 ± 6.36	39.86 ± 2.75	0.069	NS
Mitral regurgitation	**None**	44 (13.9%)	0 (0.0%)	0.001	HS
	Mild	212 (67.1%)	32 (38.1%)		
	Moderate	60 (19.0%)	52 (61.9%)		
	Severe	0 (0.0%)	0 (0.0%)		
Hemoglobin (gm/dl)		12.98 ± 1.23	11.76 ± 1.34	0.001	HS
Platelets (number/mm^3)		248721.52 ± 64772.12	257095.24 ± 75812.64	0.311	NS
HDL (mg/dl)		38.34 ± 7.93	36.33 ± 5.31	0.029	S
LDL (mg/dl)		139.57 ± 27.25	147.67 ± 28.80	0.017	S
Triglycerides (mg/dl)		177.99 ± 32.62	195.29 ± 30.91	0.001	HS
Creatinine (mg/dl)		1.17 ± 0.23	1.67 ± 0.42	0.001	HS
Urea (mg/dl)		38.13 ± 7.96	47.38 ± 17.68	0.001	HS

Data are presented mean ± SD and number of (%) or median, BMI: Body Mass Index, SBP: systolic blood pressure, DBP: diastolic blood pressure, ESD: end-systolic dimension, EDD: end-diastolic dimension, HDL: high-density lipoprotein, LDL: low-density lipoprotein, P-value >0.05: Non-significant (NS); P-value <0.05: Significant (S); P-value< 0.01: highly significant (HS), *: Chi-square test; •: Independent t-test.

Table 2: Post Hoc analysis

	Non-MACE No. = 316	MACE No. = 84	P-value	Sig.
Random Blood Glucose (Admission) (mg/dl)				
Median(IQR)	142 (126 - 196)	235 (144 - 320)	0.001	HS
RBG≤120	72 (22.8%)	12 (14.3%)	0.001	HS
RBG (121 - 200)	176 (55.7%)	28 (33.3%)		
RBG (201 - 250)	28 (8.9%)	4 (4.8%)		
RBG >250	40 (12.7%)	40 (47.6%)		
Post Hoc analysis				
RBG≤120 No. (%)	72 (85.7%)	12 (14.3%)	0.001	HS
RBG (121 - 200) No. (%)	176 (86.3%)	28 (13.7%)		
RBG (201 - 250) No. (%)	28 (87.5%)	4 (12.5%)		
RBG >250 No. (%)	40 (50.0%)	40 (50.0%)		

Post Hoc analysis by LSD

P1	P2	P3	P4	P4	P6
0.899	0.803	0.001	0.218	0.001	0.001

Data are presented number of (%), RBG: random blood glucose, P-value >0.05: Non-significant (NS); P-value <0.05: Significant (S); P-value< 0.01: highly significant (HS) *: Chi-square testP1: RBG≤120 Vs RBG (121 - 200), P2: RBG≤120 Vs RBG (201 - 250), P3: RBG≤120 Vs RBG >250, P4: RBG (121 - 200) Vs RBG (201 - 250), P5: RBG (121 - 200) Vs RBG >250, P6: RBG (201 - 250) Vs RBG >250

ROC curve of random blood glucose (admission) as a predictor of MACE revealed that the incidence of MACE increases when the admission blood glucose level exceed 223 mg/dl with Specificity 86.08% and Sensitivity 52.38%. (Figure 1).

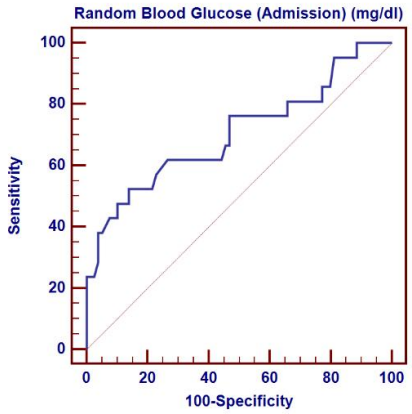

Fig. 1: ROC curve of random blood glucose (admission) as a predictor of MACE

Our results of the logistic regression analysis for predictors of MACE in the study, both in univariate and multivariate models. In the univariate model, all variables except sex were found to be significant predictors of MACE, with p-values <0.05. Specifically, older age, higher BMI, lower SBP and DBP, higher pulse rate, admission RBG level >223 mg/dl, lower EF, larger ESD and EDD measurements, presence of moderate or severe mitral regurgitation, higher triglyceride levels, higher creatinine levels, higher urea levels, and in-hospital CHF were all identified as significant predictors of MACE. In the multivariate model, only age, BMI, SBP, DBP, ESD, admission RBG level >223 mg/dl, and the presence of moderate or severe mitral regurgitation remained significant predictors of MACE, with p-values <0.05. Specifically, older age, higher BMI, lower SBP and DBP, larger ESD measurement, admission RBG level >223 mg/dl, and the presence of moderate or severe mitral regurgitation were associated with increased odds of MACE, while higher SBP and DBP were associated with decreased odds of MACE (Table 3).

Table 3: Logistic regression analysis for predictors of MACE

	Uni-variety				Multi-variety			
	P-value	Odds ratio (OR)	95% C.I. for OR		P-value	Odds ratio (OR)	95% C.I. for OR	
			Lower	Upper			Lower	Upper
Age	0.001	1.055	1.026	1.084	0.114	1.057	0.987	1.131
Sex	0.049	1.694	1.003	2.862	0.834	0.862	0.216	3.440
BMI	0.001	1.156	1.072	1.246	0.020	1.362	1.050	1.766
SBP	0.001	0.971	0.960	0.983	0.001	0.857	0.791	0.930
DBP	0.001	0.968	0.950	0.985	0.001	1.302	1.138	1.491
Pulse	0.001	1.043	1.029	1.057	0.102	1.034	0.993	1.077
RBG admission>223	0.001	6.800	3.988	11.595	0.062	0.124	0.014	1.113
EF	0.001	0.876	0.846	0.906	0.045	1.142	1.003	1.300
ESD	0.001	1.215	1.149	1.284	0.001	1.408	1.145	1.730
EDD	0.001	1.103	1.062	1.145	0.716	0.980	0.881	1.091
Mitral regurge	0.001	6.933	4.112	11.691	0.004	7.255	1.879	28.008
Hemoglobin	0.001	0.476	0.385	0.589	0.571	0.868	0.533	1.415
LDL	0.018	1.010	1.002	1.019	0.006	0.962	0.935	0.989
Triglycerides	0.001	1.017	1.009	1.026	0.002	1.033	1.012	1.055
Creatinine	0.001	98.776	36.380	268.190	0.001	343.917	28.298	4179.764
Urea	0.001	1.072	1.047	1.098	0.001	0.893	0.838	0.953
In-Hospital CHF	0.001	40.800	19.008	87.577	0.001	250.803	23.715	2652.439

BMI: Body Mass Index, SBP: systolic blood pressure, DBP: diastolic blood pressure, RBG: random blood glucose, ESD: end-systolic dimension, EDD: end-diastolic dimension, LDL: low-density lipoprotein, P-value >0.05: Non-significant (NS); P-value <0.05: Significant (S); P-value< 0.01: highly significant (HS) *: Chi-square test; Independent t-test.

4. Discussion

Numerous research has examined the potential direct influence of hyperglycemia on unfavorable outcomes among individuals with acute coronary syndrome, using several pathophysiological pathways. Several investigations have shown that hyperglycemia has a deleterious impact on ischemic myocardium. According to reports, the presence of acute hyperglycemia has been shown to eliminate the protective effects of ischemia preconditioning and facilitate the occurrence of apoptosis (Ishihara *et al.,* 2003; Ceriello *et al.,* 2002).

In our study (MACE group) and (non-MACE group) had statistically highly significant difference regarding age and BMI. This came in agreement with Cuiping Low Wang *et al.* (2016).

The study determined that older persons (aged ≥60 years) with STEMI had a greater risk of MACE compared to younger adults without STEMI (aged <60 years). This finding is consistent with the revised annual data report by Mozaffarian *et al.* (2016) from the AHA. According to the source cited as Mozaffarian *et al.,* (2016), comparison between (MACE group) and (non-MACE group) showed statistically significant difference regarding sex, on another hand prevalence of MACE in male patients (66.7%) was higher than female (34.8%) found that the incidence of STEMI is higher among males compared to females. Furthermore, this finding aligns with the research undertaken by Blondeau *et al.* (2016). Approximately 70% of the STEMI cases occurred in men. Previous western STEMI registries have reported a mean age of 61–67 years, which is higher than 55 found in our data. This came in accordance with the Egyptian participation in ACCA-EAPCI Registry on ST elevation myocardial infarction where Egyptian patients were younger Vs other European nations (mean age 55.4 ± 11.3 vs. 62.9 ± 12.4; p value < 0.001).Also came in agree with Badiger *et al.* (2019) who studied the relation of hyperglycemia and myocardial infarction and concluded that increasing the in MI due to increasing stress hormones like cortisol and catecholamines but in our study only in STEMI patients Both (MACE group) and (Non-MACE group) when were compared to each other regarding hemodynamics (SBP,DBP, heart rate) on admission showed statistically highly significant difference for all and also we noticed more hemodynamic instability in MACE group as patients developed cardiogenic shock, new onset arrhythmia and acute heart failure and this came in agree with Diabetes and Vascular Disease Research and Badiger, (2019) concluded that increasing of hemodynamic instability in MI due to increasing stress hormones like cortisol and catecholamines that lead to arrhythmia and cardiogenic shock and hemodynamics instability

Regarding laboratory findings Comparison between (non-MACE group) and (MACE group) revealed statistically significant difference regarding HDL, LDL, on another hand all patients had high mean level of LDL in both groups that implicate the risk of STEMI and also, revealed statistically highly significant difference regarding HB, Triglycerides, creatinine and urea with P-value 0.000 for all. We noticed patients in (MACE group) and (non-MACE group) had median Triglycerides level respectively that mean all of our patients are dyslipidimic and we noticed the more dyslipidemia the higher incidence of MACE. And this came in agreement with study conducted by Worthley *et al.,* (2007).

This research demonstrates the presence of statistically significant differences across four distinct groups. The findings presented here contradict the results of a research done by Timmer *et al.* (2011), which demonstrated that there was no statistically significant difference between the two groups. The obtained p-value is 0.22. During the echocardiography examination, it was observed that the EF in the group experiencing MACE varied between 25% and 55%, with a median value of 37.43 ± 8.16. In contrast, the non-MACE group exhibited an EF range of 25% to 66%, with a median value of 45.63 ± 6.97. This finding corresponds to the research undertaken by Dziewierz *et al.* (2010). This research included the identification of 607 individuals with AMI who had full admission glucose data in the Krakow Registry of Acute Coronary Syndromes. These patients were then categorized based on their glucose admission levels. The patients were categorized into three distinct groups according to their non-fasting glucose levels upon admission. A statistically significant difference occurred among the three groups, as shown by a P value of 0. 016 (Li *et al.,* 2011). Regarding incidence of MACE among our patients regarding in Hospital Death, In-Hospital Reinfarction, In-Hospital CHF and cardiogenic shock There was highly significant difference among the both groups with (P value =0.001) for all item. This also came in agreement with the study conducted by Ekmekci *et al.* (2014) [15]. The objective of this research was to assess the potential predictive value of hyperglycemia in relation to mortality during hospitalization.

The findings of our study indicate a statistically significant difference in the median RBG level between the MACE group and the non-MACE group (235 mg/dl vs 142 mg/dl, respectively), with a p-value of 0.001, which is considered very significant. Upon categorizing the patients into four distinct groups according to their RBG levels, a notable correlation emerged between elevated RBG levels and a marked rise in the occurrence of MACE. Specifically, patients with RBG levels ≤120 mg/dl had the lowest incidence of MACE (14.3%), while those with RBG levels >250 mg/dl had the highest incidence of MACE (47.6%). These differences were highly significant, with a p-value of 0. 001. This finding corresponds to the research done by Chen *et al.,* 2014 [16]. In their study, a total of 959 consecutive patients with STEMI who had primary PCI were categorized into 5 categories based on their admission glucose levels: <100, 100–139, 140–189, 190–249, and ≥250 mg/dL. A comparison was made between their short-term and long-term results. The researchers discovered a higher incidence of periprocedural mortality among patients with a fasting blood sugar level over 250 mg/dl. A statistically significant difference was seen among the five groups ($p < 0.001$). This finding is consistent with the research done by Moustafa *et al.* (2017), which comprised 250 patients without a known history of diabetes mellitus who were hospitalized with STEMI. Both glucose and glycated hemoglobin (HbA1c) levels were assessed upon admission. All individuals included in the study had a hemoglobin A1c level below 6.5%. MACE, including death, heart failure, arrhythmias, cardiogenic shock, and recurrent ischemia, were recorded both during the hospital stay and during the three-month follow-up period. The participants were categorized into two groups based on their admission mean glucose levels. Group A consisted of individuals with glucose levels more than or equal to 160 ± 52 mg/dl, whereas group B included those with glucose levels below 160 ± 52 mg/dl. A statistically significant difference was observed between the two groups, with a P value of 0.01. Our study showed that other surrogates of in-hospital mortality occurred more in the hyperglycemic, a recurrent finding in studies of hyperglycemia in acute coronary syndrome. Patients in hyperglycemic suffered more. from cardiogenic shock and congestive heart failure a finding that the latest CardShock Study (Kataja *et al.,* 2017) has found in both ACS and non-ACS forms of cardiogenic shock, which proved that The group of patients with severe hyperglycemia had the greatest rate of in-hospital death at 56%, whereas the normoglycemic group had a mortality rate of 22% (P value 0.01). Identifying extreme hyperglycemia as a standalone prognostic factor for death during a patient's hospital stay. In our investigation, we observed a notable disparity in the occurrence of cardiogenic shock between the group experiencing MACE and the group not experiencing MACE. Specifically, the incidence of cardiogenic shock was shown to be substantially greater in the MACE group, with a prevalence of 66.7%, compared to the non-MACE group, which exhibited a prevalence of 33.3%. This finding indicates that the presence of cardiogenic shock is a strong indicator of worse outcomes in individuals diagnosed with cardiovascular disease. This finding corresponds to the research undertaken by Worthley *et al.* (2007). This research included the evaluation of 980 individuals who presented with an ST-segment elevation myocardial infarction and were only treated with primary angioplasty. The research conducted by Stefanini and Windecker, (2015) found that incidence of cardiogenic shock was high in group four with high RBS. The incidence of in-hospital reinfarction is significantly higher in the MACE group compared to the non-MACE group (4.8% vs 95.2%). This finding corresponds to the research done by Moustafa, (2017), where a total of 250 patients without a known history of diabetes mellitus were included in the study and hospitalized with STEMI. Upon admission, measurements were taken for both glucose and HbA1c. All individuals included in the study had a hemoglobin A1c level below 6.5%. The study recorded major cardiac events (MACE), including death, heart failure, arrhythmias, cardiogenic shock, and recurrent ischemia, both during the hospital stay and during the three-month follow-up period. The individuals were categorized into two distinct groups based on their admission mean glucose level (Tomizawa *et al.,* 2015). In group A, a total of 49 patients (38%) had re-infarction, while in group B, 16 patients (13.3%) got re-infarction.

Our study results shows that about In-hospital reinfarction: In the MACE group, 4.8% of patients had an in-hospital reinfarction, while this outcome was not observed in the non-MACE group. The test value is 15.200, with a P-value of 0.001, suggesting a highly significant association between in-hospital reinfarction and the MACE group. This finding is consistent with the research done by Moustafa, (2017), where all participants involved in the study had hemoglobin A (1c) levels below 6.5%. Major cardiac events, including death, heart failure, arrhythmias, cardiogenic shock, and recurrent ischemia, were reported both during the hospital stay and within a period of three months.

The participants were categorized into two groups based on their admission mean glucose level. Group A consisted of individuals with a glucose level more than or equal to 160 ± 52 mg/dl, whereas group B comprised those with a glucose level below 160 ± 52 mg/dl. In group A, a total of 49 patients (38%) had re-infarction, while in group B, 16 patients (13.3%) got re-infarction. The p-value observed in the study was 0.01. Regarding ventricular arrhythmia, it was observed that 33.33% of patients in the MACE group encountered this condition, but none of the patients in the Non-MACE group exhibited ventricular arrhythmia. The obtained test result is 113.262, accompanied by a P-value of 0.001, which suggests a statistically significant relationship between ventricular arrhythmia and the MACE group. This finding is consistent with a research done by Tran *et al.* (2018), which elucidated the correlation between hyperglycemia and the incidence of VT in patients admitted to the hospital with AMI. Hyperglycemia was defined as a serum glucose level ≥ 140 mg/dl at the time of hospital admission.

In our study we studied the relation between MACE with ABGL through ROC curve, it is concluded that the cut off value of ABGL was 223 mg/dl which above it the incidence of MACE increase with Specificity 86.08% and Sensitivity 52.38 %. and we depended here on the random blood glucose on admission to assess this value on the in hospital outcome but the definition of random hyperglycemia is blood sugar over 200mg/dl or more than 11 m mole, so we can influence anew definition for hyperglycemia that ABGL over 223 mg/dl we can expect MACE but the main issue is STEMI is a complicated disease and has a lot of risk factors other than DM or acute hyperglycemia in none diabetic people like dyslipidemia, HTN, smoking and etc.

Limitations

The limited size of the study population might be attributed to many reasons, including the relatively short period of the trial and the delayed presentation of certain patients beyond the acceptable timeframe for primary PCI. Several patients declined to undergo PCI at our medical facility, citing logistical or cultural concerns. Additionally, the newly implemented database in our department is still developing its capabilities in facilitating accurate data gathering and effective follow-up procedures.

Conclusions

Patients exhibiting excessive blood glucose levels are at a heightened risk of having several adverse cardiovascular outcomes, including TIMI 0 "no-reflow," in-hospital mortality, cardiogenic shock, ventricular arrhythmia, acute heart failure, and reinfarction.

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References

Allan, G.M., S. Garrison, and J. McCormack, 2014. Comparison of cardiovascular disease risk calculators. Curr. Opin. Lipidol., 25:254-65.

Badiger, S., 2019. Hyperglycaemia and Myocardial Infarction. Br. J. Medical Pract.,12:1-12.

Blondeau, M., M.K. Rashid, N. Guron, J. Bernick, G.A. Wells, A.-Y. Chong, et al., 2016. Safety and efficacy of a pharmacoinvasive strategy in ST-segment elevation myocardial infarction: a patient population study comparing a pharmacoinvasive strategy with a primary percutaneous coronary intervention strategy within a regional system. Cardiovasc Interv., 9:2014-20.

Ceriello, A., L. Quagliaro, M. D'Amico, C. Di Filippo, R. Marfella, F. Nappo, et al., 2002. Acute hyperglycemia induces nitrotyrosine formation and apoptosis in perfused heart from rat. Diabetes., 51:1076-82.

Chen, P.C., S.K. Chua, H.F. Hung, C.Y. Huang, C.M. Lin, S.M. Lai, et al., 2014. Admission hyperglycemia predicts poorer short- and long-term outcomes after primary percutaneous coronary intervention for ST-elevation myocardial infarction. J. Diabetes Investig, 5:80-6.

Dziewierz, A., Z. Siudak, T. Rakowski, W. Zasada, J.S. Dubiel, and D. Dudek, 2010. Impact of multivessel coronary artery disease and noninfarct-related artery revascularization on outcome of patients with ST-elevation myocardial infarction transferred for primary percutaneous coronary intervention (from the EUROTRANSFER Registry). Am. J. Cardiol., 106:342-7.

Ekmekci, A., G. Cicek, M. Uluganyan, B. Gungor, F. Osman, K.S. Ozcan, et al., 2014. Admission hyperglycemia predicts inhospital mortality and major adverse cardiac events after primary percutaneous coronary intervention in patients without diabetes mellitus. Angiology, 65:154-9.

Ishihara, M., I. Inoue, T. Kawagoe, Y. Shimatani, S. Kurisu, K. Nishioka, et al., 2003. Impact of acute hyperglycemia on left ventricular function after reperfusion therapy in patients with a first anterior wall acute myocardial infarction. Am. Heart J., 146:674-8.

Kataja, A., T. Tarvasmäki, J. Lassus, J. Cardoso, A. Mebazaa, L. Køber, et al., 2017. The association of admission blood glucose level with the clinical picture and prognosis in cardiogenic shock - Results from the CardShock Study. Int. J. Cardiol., 226:48-52.

Li, D.B., Q. Hua, J. Guo, H.W. Li, H. Chen, and S.M. Zhao, 2011. Admission glucose level and in-hospital outcomes in diabetic and non-diabetic patients with ST-elevation acute myocardial infarction. Intern Med., 50:2471-5.

Low Wang, C.C., C.N. Hess, W.R. Hiatt, A.B. Goldfine, 2016. Clinical update: Cardiovascular disease in diabetes mellitus: Atherosclerotic cardiovascular disease and heart failure in type 2 diabetes mellitus - mechanisms, management, and clinical considerations. Circulation, 133:2459-502.

Moustafa, T.M., 2017. Utility of admission blood glucose level in prediction of short-term course and extent of coronary artery occlusion in non-diabetic patients with ST segment elevation myocardial infarction. IJC Metabolic & Endocrine, 14:16-20.

Mozaffarian, D.B.E., A.S. Go, et al., 2016. On behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2016 update: a report from the American Heart Association. Circulation, 133:38- 40.

Pawel, B., and W. Henryk, 2012. The new ESC guidelines for dyslipidemia management - Key points. . Polski Przeglad Kardiologiczny, 14:59–62.

Ray, K.K., C.P. Cannon, D.A. Morrow, A.J. Kirtane, J. Buros, N. Rifai, et al., 2007. Synergistic relationship between hyperglycaemia and inflammation with respect to clinical outcomes in non-ST-elevation acute coronary syndromes: analyses from OPUS-TIMI 16 and TACTICS-TIMI 18. Eur Heart J., 28:806-13.

Stefanini, G.G., and S.Windecker, 2015. Can coronary computed tomography angiography replace invasive angiography? Coronary computed tomography angiography cannot replace invasive angiography. Circulation, 131:418-25.

Timmer, J.R., J.P. Ottervanger, M.J. de Boer, J.H. Dambrink, J.C. Hoorntje, A.T. Gosselink, et al., 2005. Hyperglycemia is an important predictor of impaired coronary flow before reperfusion therapy in ST-segment elevation myocardial infarction. J. Am. Coll Cardiol., 45:999-1002.

Timmer, J.R., M. Hoekstra, M.W. Nijsten, I.C. van der Horst, J.P. Ottervanger, R.J. Slingerland, et al., 2011. Prognostic value of admission glycosylated hemoglobin and glucose in nondiabetic patients with ST-segment-elevation myocardial infarction treated with percutaneous coronary intervention. Circulation, 124:704-11.

Tomizawa, N., T. Nojo, S. Inoh, and S.Nakamura, 2015. Difference of coronary artery disease severity, extent and plaque characteristics between patients with hypertension, diabetes mellitus or dyslipidemia. Int. J. Cardiovasc Imaging, 31:205-12.

Tran, H.V., J.M. Gore, C.E. Darling, A.S. Ash, C.I. Kiefe, and R.J. Goldberg, 2018.Hyperglycemia and risk of ventricular tachycardia among patients hospitalized with acute myocardial infarction. Cardiovasc Diabetol., 17:13-6.

Worthley, M.I., A.S. Holmes, S.R. Willoughby, A.M. Kucia, T. Heresztyn, S. Stewart, et al., 2007. The deleterious effects of hyperglycemia on platelet function in diabetic patients with acute coronary syndromes mediation by superoxide production, resolution with intensive insulin administration. J Am Coll Cardiol., 49:304-10.