University Heart Journal
Vol. 17, No. 2, July 2021

Correlation between Insulin Resistance and LVEF in non Diabetic Chronic Heart Failure Patients admitted in a Tertiary Care Hospital

MD. AZHARUL ISLAM[1], MANZOOR MAHMOOD[1], KHURSHED AHMED[1], SAJAL KRISHNA BANERJEE[1], SYED ALI AHSAN[1], CHAUDHURY MESHKAT AHMED[1], A.K.M. IMTIAZ AKAND[1], SUJOY KUMAR SAHA[1], FYSAL FARUQ[1], KAMRUZZMAN SIDDIKI[1], AKM FAZLUR RAHMAN[1], MD. FAKHRUL ISLAM KHALED[1], SM MUSTAFA ZAMAN[1], FARIDA YEASMIN[2], PARVEEN AKTER[3], MD. HARISUL HOQUE[1]

[1]Department of Cardiology, Bangabandhu Sheikh Mujib Medical University, Dhaka, [2]Department of Nuclear Medicine, National Institute of Nuclear Medicine and Allied Science, Shahbagh, Dhaka, [3]Kurmitola General Hospital, Dhaka,

Address of Correspondent: Dr. Md. Azharul Islam, Resident (Phase-B), Department of Cardiology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Email: azharulrafi28@gmail.com.

Abstract:

Background: Insulin resistance is a well-established composite index of systemic inflammatory and metabolic disorders. A wide variety of methods like, HOMA-IR (Homeostatic model assessment insulin resistance), FGIR (Fasting glucose insulin ratio), ISI-Composite (an index of whole body insulin sensitivity), QUICKI (quantitative insulin sensitivity check index) etc are available for assessing IR.

Objective: To find out the correlation between insulin resistance and LVEF in non diabetic chronic heart failure patients.

Methodology: This cross sectional study was carried out in the Department of Cardiology in Bangabandhu Sheikh Mujib Medical University, Shahbagh, Dhaka from February, 2019 to June, 2020. Patients admitted with chronic heart failure with reduced ejection fraction were included in this study. Patients with diabetic, prediabetic and patient who did not give written informed consent were excluded in this study.

Results: LVEF 25-29% was 16 patients out of which 10(66.7%) had significant insulin resistance. LVEF 30-34% was found in 28 patients, among them 16(41.0%) had no insulin resistance. LVEF 35-39% was found in 19 patients out of which 18(46.2%) had no insulin resistance. The difference was statistically significant ($p<0.05$). A negative correlation ($r=-0.340$; $p=0.006$) was found between insulin resistance and LVEF.

Conclusion: Majority non diabetic chronic heart failure patients had no insulin resistance. Significant negative correlation was found between insulin resistance and LVEF.

University Heart Journal 2021; 17(2): 99- 102

Introduction:

Heat failure (HF) occurs in individuals with diabetes at higher rates, even in the absence of other HF risk factors such as coronary artery disease and hypertension. Patients with HF are also at risk of developing incident diabetes over time. The high prevalence of ischemic heart disease and cardiovascular risk factors significantly contribute to the development of cardiomyopathy and HF in patients with diabetes.[1] As Bangladesh is a developing country heat failure contributing a major health burden to the society. World wide the incidence of heart failure is variable but increasing with advancing age. Approximately 26 million people world wide are suffering from heart failure.[2] Effective modulation of some heart failure–related outcomes with metformin treatment was related to its beneficial effects in ameliorating insulin resistance and blocking pro-inflammatory markers such as the aging-associated cytokine CCL11 (C-C motif chemokine ligand 11).[3] Insulin resistance is a well-established composite index of systemic inflammatory and metabolic disorders. Mounting evidence reveals that insulin resistance predicts and, to some extent, mediates the development of atherosclerosis, myocardial infarction and in-stent restenosis. The predictive role of insulin resistance for LV remodeling and incident CHF has also been proposed. Especially, a unique concentric LV remodeling pattern was

Received: 19 March 2021 **Accepted:** 10 May 2021

characterized in relatively healthy subjects with insulin resistance.[4] A wide variety of methods like, HOMA-IR (Homeostatic model assessment insulin resistance), FGIR (Fasting glucose insulin ratio), ISI-Composite (an index of whole body insulin sensitivity), QUICKI (quantitative insulin sensitivity check index) etc are available for assessing IR. But simpler and inexpensive methods may be appropriate provided the investigator is aware of their limitations.[5] This study has been planned to investigate the presence of abnormalities of insulin sensitivity in non diabetic chronic heart failure patients with reduced ejection fraction.[5]

Methodology:

This cross sectional study was carried out in the Department of Cardiology in Bangabandhu Sheikh Mujib Medical University, Shahbagh, Dhaka during February, 2019 to June, 2020. Patients admitted with chronic heart failure with reduced ejection fraction were included in this study. Patients with diabetic, prediabetic and patient who did not give written informed consent were excluded in this study. After getting consent, meticulous history including demographic data (such as age, sex), risk factors profile including smoking, hypertension, diabetes, dyslipidemia, family history of ischemic heart disease were taken and relevant clinical examinations (general, cardiovascular and respiratory) were performed and recorded in a pre designed structured proforma. Standard 12 lead ECG was recorded at a 25 mm/s paper speed and a gain of 10 mm/mV with the patient fully relaxed in the supine position. CXR P/A was done. Transthoracic echocardiography was done to assess the RWMA, LV dysfunction, LVEF. Other laboratory investigations such as fasting insulin level, fasting and 2-h after breakfast blood glucose level, HbA1c, Fasting lipid profile, S.creatinine were done. Insulin resistance was calculated by using HOMA-IR formula (HOMA-IR >1.9 and HOMA-IR >2.9 considered as early and significant insulin resistance). Separate data collection sheet was used for each subject with maintaining confidentiality. Highest level of confidentiality and ethical standard was maintained during storage and analysis of the data. Data was collected according to the pre designed semi-structured data collection sheet. Statistical analyses were carried out by using the Statistical Package for Social Sciences (SPSS) version 23.0 for Windows Software. Continuous data were expressed as mean ± standard deviation (SD) and categorical data were expressed as frequency and percentages. Mean and standard deviation were calculated for quantitative variables and was analyzed by *Bonferroni Test*. Chi square test was used for categorical variables. The association of LVEF with insulin resistance was done by Pearson's correlation coefficient test. P values <0.05 was considered as statistically significant.

Results:

Out of 63 patients, male were predominant 41(65.1%) with male-female ratio was 1.8:1. Mean age was found 59.65±8.52 years with range from 42 to 80 years. Mean BMI was 23.18±2.39 kg/m^2 with range from 18.3 to 29.5 kg/m^2. Regarding co-morbidities majority patients had hypertension 40(63.5%) followed by dyslipidemia 37(58.7%), history of myocardial infarction 32(50.8%), smoking 29(46.0%), family history of IHD 17(27.0%) and obesity 11(17.5%) (Table-1). Regarding left ventricular ejection fraction (LVEF) in this study most of the patients had LVEF 30-34%, 28(44.4%) followed by 19(30.2%) were LVEF 35-39% and 16(25.4%) were LVEF 25-29% (Fiugre-1). Most of the patients 39(61.9%) had no insulin resistance, 15(23.8%) of patients had significant insulin resistance and 9(14.3%) patients had early insulin resistance (Table-2). LVEF 25-29% was found in 16 patients out of which 10(66.7%) had significant insulin resistance. LVEF 30-34% was found in 28 patients, among them 16(41.0%) had no insulin resistance. LVEF 35-39% was found in 19 patients out of which 18(46.2%) had no insulin resistance. The difference was statistically significant (p<0.05) (Table-3). A negative correlation (r=-0.340; p=0.006) between LVEF and insulin resistance (Figure-2).

Table-I

Baseline characteristics of study patients (n=63)

Parameters	Frequency	Percentage
Gender		
Male	41	65.1
Female	22	34.9
Mean age (years)	59.65±8.52	
Mean BMI (kg/m^2)	23.18±2.39	
Co-morbidities		
Hypertension	40	63.5
Dyslipidemia	37	58.7
H/O of myocardial infarction	32	50.8
Smoking	29	46.0
Family history of IHD	17	27.0
Obesity	11	17.5

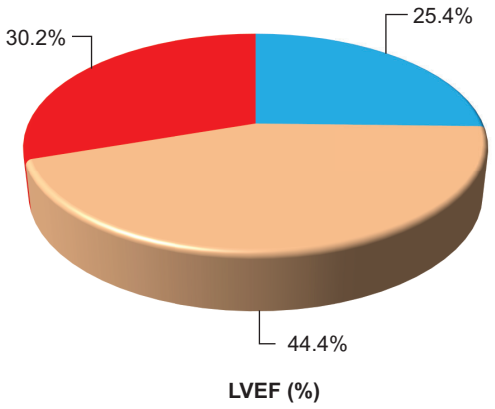

Fig.-1: *Pie chart showing LVEF of the study patients (n=63)*

Table-II

Prevalence of insulin resistance of the study patients (n=63)

Insulin resistance	Frequency	Percentage
No resistance	39	61.9
Early resistance	9	14.3
Significant resistance	15	23.8

Table-III

Relation between LVEF with Insulin Resistance

	Pattern of Insulin Resistance				
LVEF	No resistance n=39 (%)	Early resistancen n=9 (%)	Significant resistancen n=15 (%)	Total	p value
25-29%	5(12.8)	1(11.1)	10(66.7)	16	0.001[s]
30-34%	16(41.0)	7(77.8)	5(33.3)	28	
35-39%	18(46.2)	1(11.1)	0(0.0)	19	
Total	39(100)	9(100)	15(100)	63	

s=significant; p value reached from Chi square test

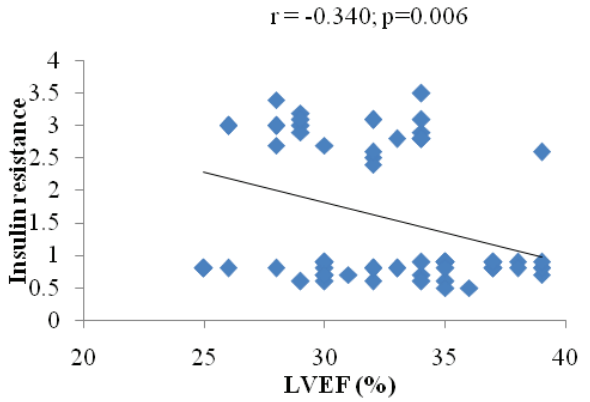

Fig.-2: *Scatter diagram showing negative correlation between LVEF and insulin resistance.*

Discussion:

In this study out of 63 patients, male were predominant 41(65.1%) with male-female ratio was 1.8:1. Al-Jarallah et al.[6] reported 60.0% of the patients were male. ALZadjali et al.[7] reported male was found 76.0% and female was 24.0%. Julián et al.[8] found male was 78.5%. In Vafaeimanesh et al.[9] study, 120 non-diabetic cases were evaluated and 53.5% were males which also support our study.

In our study mean age were 59.65±8.52 years with range from 42 to 80 years. Al-Jarallah et al.[6] study reported the mean age was 63.0±11.0 years, ranging from 18 to 99 years. ALZadjali et al.[7] also supported our observation. They found mean age(+-SD) was found 69.2±10.4 years. Vafaeimanesh et al.[9] also found similar observation. They showed the average age of the population was 57.8±12.69 years and 60% of them were 50-70 years old. Julián et al.[8] reported the mean age was 64±13.2 years.

We found that mean BMI was 23.18±2.39 kg/m^2 with range from 18.3 to 29.5 kg/m^2. Bahijri et al.[10] found 113 subjects (87.7%), were either obese or overweight; and 73 (54.1%) had abdominal obesity (>102 and >88 cm for males and females, respectively). In contrast, subjects in the LIR subgroup had normal BMI, and none suffered from abdominal obesity. Julián et al.[8] found the mean BMI was 27.7 kg/m^2. Al-Jarallah et al.[6] found the mean BMI was 29.7±6.6 kg/m^2 which is almost as our finding.

Regarding co-morbidities majority patients had hypertension 40(63.5%) followed by dyslipidemia 37(58.7%), history of myocardial infarction 32(50.8%), smoking 29(46.0%), family history of IHD 17927.0%) and obesity 11(17.5%). In study of Al-Jarallah et al.[6] showed 1843 (81.6%) patients had hypertension and 1228 (54.4%) patients had dyslipidemia. Julián et al.[8] reported previous history of myocardial infarction was 43.8%.

In the study, it was found that most 28(44.4%) of the patients had LVEF 30-34% followed by 19(30.2%) were LVEF 35-39% and 16(25.4%) were LVEF 25-29%. Al-Jarallah et al.[6] reported the mean EF was 35% (25–45%). Julián et al.[8] observed that the mean LVEF was found 30.4±8.4%.

In our study showed most of the patients 39(61.9%) had no insulin resistance, 15(23.8%) of patients had significant insulin resistance and 9(14.3%) patients had early insulin resistance. Vafaeimanesh et al.[9] reported 66 (55%) patients had insulin resistance (HOMA-IR> 2.5) and 54 (45%) patients did not have insulin resistance. Bahijri et al.[10] observed 135 subjects (64.6% of the studied population) were considered to have high insulin resistance.

We found that LVEF 25-29% was 16 patients out of which 10(66.7%) had significant resistance. LVEF 30-34% was found in 28 patients. Among them 16(41.0%) had no insulin resistance. LVEF 35-39% was observed in 19 patients out of which 18(46.2%) had no insulin resistance. The difference was statistically significant ($p<0.05$). Swan et al.[11] found that patients with ischemic heart disease and normal left ventricular function were insulin resistant and hyperinsulinemic but to a significantly lesser degree than patients with CHF due to ischemic heart disease. This finding supports the suggestion that the abnormalities of insulin metabolism occur secondary to the heart failure itself, possibly resulting from circulatory changes or as part of the overall neurohormonal response to heart failure.

We found a negative correlation ($r=-0.340$; $p=0.006$) between insulin resistance and LVEF. Scherbakov et al.[12] reported additionally, linear regression analyses revealed an association of fasting IR with HFpEF ($r=0.64$, $P<0.01$). So, insulin resistance is associated with heart failure both HFpEF and HFpEF, although a negative correlation is established between LVEF and insulin resistance by this study.

Conclusion:

Majority non diabetic chronic heart failure patients had no insulin resistance. Significant negative correlation was found between insulin resistance and LVEF.

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