

The Relationship Between Hba1c Level and Beck Depression Scale in Heart Failure Patient With Tip 2 Diabetes Mellitus

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ABSTRACT

Introduction: Multiple studies have shown the relationship between HF and development of depression. Several studies have shown that perceived quality of life among patients with type 2 diabetes mellitus (T2DM). We aimed to assess the association between HbA1c levels and depression in diabetic HF patients.

Materials and Method: Between July 2015 and June 2016, 179 patients with HF (LV-EF <35%) -and T2DM were included in this study. Blood samples for HbA1c were obtained from patients with T2DM. Severity of depression was assessed using Beck Depression Inventory (BDI). Patients with depression were classified as follows: Minimal with score 0-13 (group I), mild with score 14-19 (group II), moderate with score 20-28 (group III), and severe with score 29-63 IV).

Results: The median age of the study population was 64 (57-75) (Female: 98, M: 81). There was no significant difference between the groups regarding the frequency of hypertension and gender. There was a significant positive correlation between BDI and HbA1c levels in patients with HF ($r = 0,488$, $p < 0,001$). II and III (6.0 ± 1.47 , 6.4 ± 0.6 , 7.03 ± 0.7 , 7.6 ± 1.23 , and 7.6 ± 1.23 , respectively) compared with the control group. respectively, $p < 0,01$), which indicates the association between severity of depression and HbA1c level.

Conclusion: We detected significant association between BDI and HbA1c levels in chronic HF patients with T2DM. So, more strict control of blood glucose levels may improve quality of life and decrease depressive symptoms in diabetic HF patients.

Keywords: Beck Depression Scale; HbA1c; Heart Failure; diabetes mellitus

Tip 2 Diabetes Mellitusu Olan Kalp Yetmezlikli Hastalarda Hba1c Seviyesi ile Beck Depresyon Skalası Arasındaki İlişki

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ÖZET

Giriş: Kalp yetmezliği dünya çapında morbidite ve mortalitenin önde gelen nedenlerinden biridir. Birçok çalıma kalp yetmezliği ile depresyon gelişimi arasındaki ilişkiyi göstermiştir. Bazı çalışmalar tip 2 diabetes mellitus olanlarda yaşam kalitesinin bozulduğunu göstermiştir. Diyabetik kalp yetmezlikli hastalarda HbA1c düzeyleri ile depresyon arasındaki ilişkiyi değerlendirmeyi amaçladık.

Hastalar ve Metod: Temmuz 2015 ve Haziran 2016 tarihleri arasında, 179 Tip 2 DM li kalp yetmezliği olan (LV-EF <% 35) hastalar çalışmaya dahil edildi. Tip 2 DM'li hastalardan HbA1c için kan örnekleri alındı. Depresyonun şiddeti Beck Depresyon Envanteri kullanılarak değerlendirildi. Depresyonu olan hastalar aşağıdaki gibi sınıflandırıldı: Minimal skor 0-13 (grup I), hafif skor 14–19 (grup II), orta skor 20–28 (grup III) ve şiddetli skor 29–63 (grup IV).

Bulgular: Çalışma popülasyonunun medyan yaşı 64 (57-75) idi (Kadın: 98, M: 81). Hipertansiyon ve cinsiyet sıklığı açısından gruplar arasında anlamlı fark yoktu. BDI skora göre sınıflandırılan hastaların sayısı, I ila IV. Gruplarda sırasıyla 42, 45, 46 ve 46 idi. HF'li hastalarda BDI ve HbA1c düzeyleri arasında anlamlı pozitif korelasyon vardı ($r = 0,488$, $p < 0,001$). Gruplar arasında yapılan analizlere göre HbA1c değerleri grup 4 te grup I, II ve III'e göre anlamlı olarak yüksek bulundu ($6,0 \pm 1,47$, $6,4 \pm 0,6$, $7,03 \pm 0,7$, $7,6 \pm 1,23$, sırasıyla, $p < 0,01$).

Sonuç: Tip 2 DM'li kronik kalp yetmezlikli hastalarda BDI ve HbA1c düzeyleri arasında anlamlı ilişki saptadık. Bu nedenle, kan glukoz seviyesinin daha sıkı kontrolü, diyabetik kalp yetmezlikli hastalarda yaşam kalitesini artırabilir ve depresif belirtileri azaltabilir.

Anahtar Kelimeler: Beck Depresyon Skalası; HbA1c; Kalp Yetmezliği; Diyabet Hastalığı

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Introduction:

Heart failure (HF) is associated with poor quality of life, limited social functioning, and lost work capacity. (1) These conditions have a strong adverse effect on functional status, and poor functional status has implications for exercise capacity, illness severity, and quality of life in patients with HF (2–3). Depression is one of the most common psychiatric disorders (4). Initial presenting symptoms tend to include an increasingly reduced sense of self-efficacy, reduced self-care behaviors, mood swings, and in some cases increased suicidal ideation. More than 20% of HF patients suffer from depression (5). Diabetes mellitus (DM) is a chronic disease that can lead to many complications. It affects patients' quality of life, and is often associated with depression (6-7). Abundant evidence demonstrates a strong relationship between depression and HF (5–8). Comorbid DM and HF confer a significant risk of cardiovascular morbidity and mortality. Recently Dogdu et al reported an relationship between psychosocial status, DM and left ventricular systolic function in patients with stable multivessel coronary artery disease. (9)

The aim of this study was to determine the impact of glycated haemoglobin (HbA1C) on depression in HF patients with T2DM.

Methods**Study Population**

Between July 2015 and June 2016, 179 patients with HF (left ventricular ejection fraction(LVEF) < 35%) and T2DM were included in this study. Demographic data including age, hypertension, gender and marital status; etiology of HF (ischemic vs. non-ischemic), HbA1c level and New York Heart Association (NYHA class) (I-IV) were collected. T2DM was diagnosed according to ADA criteria (10). Blood samples were taken at the time of admission for HbA1c. Eligible patients were those whose NYHA class of HF were I or greater; who had an EF 35% or less by echocardiography. Patients who were mentally subnormal or who had other neurological problems, presence of type 1 DM, and gestational DM were excluded. Informed consent was obtained from each patient. The study protocol was reviewed and approved by the Local Ethics Committee of University in accordance with the Declaration of Helsinki.

Echocardiography

Left lateral decubitus position was used to obtain images during echocardiography. Transthoracic echocardiographic (Vivid 3,GE) study included measurements of the left ventricular end-systolic dimension (LVESD), left ventricular end-diastolic dimension (LVEDD), pulmonar artery pressure, LVEF as determined using the Simpson method, and left atrial dimension (LAD). The apical 4-chamber and 2-chamber images of the heart were acquired by a single sonographer. LVEF <35% was defined as heart failure.

Psychological tests

Severity of depression was assessed using Beck Depression Inventory (BDI), which consists of 21 items related to cognitive and somatic symptoms of depression (11). The items refer to sadness, pessimism, sense of failure, lack of satisfaction, guilt, feeling of punishment, self-deprecation, self-accusation, suicidal ideation, crying spells, irritability, social withdrawal, indecisiveness, distortion of body image, inhibition to work, sleep disorder, fatigue, loss of appetite, weight loss, somatic concern and decreased libido. The BDI is composed of closed questions with four options of answers for each question; each answer has a score between 0 and 3, indicating severity of symptoms. Patients with depression were classified as follows: Minimal with score 0–13 (group I), mild with score 14–19 (group II), moderate with score 20–28 (group III), and severe with score 29–63 (group IV).

Statistical analysis

All statistical analyses were performed using SPSS for Windows, version 16.0 (SPSS, Inc., IBM Armonk, NY, USA). Variables were investigated using analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk test) to determine whether or not they are normally distributed. Continuous variables were presented as medians and interquartile ranges or as mean \pm SD, as appropriate. Categorical variables were presented as observed frequencies and percentages. Group means for continuous variables were compared with Student's t-test or the Mann-Whitney U-test as appropriate. Between group comparisons were conducted using one-way analysis of variance for continuous variables and 2-test for categorical variables. Categorical variables were compared with chi-square or Fisher's exact tests. Correlation of parametric test measures were evaluated by using parametric Pearson r or nonparametric Spearman rank R , as appropriate. Statistical significance value was accepted at $p < 0.05$.

Results

The median age of the study population ($n=179$) was 64 (57-75) (Female: 98, M: 81). Demographic, clinical, laboratory and echocardiographic characteristics of the patients are summarized in Table 1. There was no significant difference between the groups regarding gender, marital status and hypertension. Ischemic etiology was the commonest cause of HF (63,7%). The median age of the group IV was significantly higher than the other groups ($p=0,007$). The number of the patients classified according to BDI scoring system (Group I to IV) was 42, 45, 46 and 46, respectively. The median Beck depression scores (Group I to IV) were 7 (4-10,25), 17(15-18), 25(23-27) and 47,5(36,75-56,25), respectively. The Beck depression score was moderately correlated with HbA1c ($r=0.488$; $P<0.01$) (**Figure 1**). The majority of the patients (71.5%) were in NYHA II to III. The median NYHA class of group IV was significantly higher than the other groups. Systolic

pulmonary artery pressure (PAPs) was compared between the 4 groups (37,6±6,3 mmHg, 39,2±7,6 mmHg, 43±8,9 mmHg, 51,6±10,1 mmHg, respectively; $p<0.001$) (Group 1 vs. Group 3 $p=0.01$; Group 1 vs. Group 4 $p=0.000$; Group 2 vs. Group 4 $p=0.000$; Group 3 vs. Group 4 $p=0.000$). The echocardiographic parameters LVEDD, LVESD and LAD were also compared between the groups ($p<0.001$, $p<0.001$, $p<0.001$, respectively). The results of the post hoc analysis for LVEDD was as follows: Group 1 vs. Group 3 $p=0.026$; Group 1 vs. Group 4 $p=0.000$; Group 2 vs. Group 4 $p=0.000$ and Group 3 vs. Group 4 $p=0.000$. Post hoc analysis was also performed for LVESD (Group 1 vs. Group 4 $p=0.000$; Group 2 vs. Group 4 $p=0.000$; Group 3 vs. Group 4 $p=0.000$) and for LAD (Group 1 vs. Group 4 $p=0.002$; Group 2 vs. Group 4 $p=0.000$; Group 3 vs. Group 4 $p=0.000$). The cut-off values of HbA1c for prediction of Group IV were detected by using Receiver–operating characteristic (ROC) cure analysis. A HbA1c value of >6.75 yielded an area under the curve (AUC) value of 0.756 (95% CI 0.678-0.835; $p < 0.001$). Furthermore, the HbA1c value >6.75 demonstrated a sensitivity of 76% and a specificity of 60% for the prediction of group IV (**Figure 2**). Furthermore, the patients were divided into 2 groups according to HbA1c levels (group I HbA1c $<6,75$ and Group II HbA1c $\geq 6,75$). The clinical and laboratory characteristics of the patients according to HbA1c levels are shown in **Table 2**. BDI scores and PABs were significantly different between these 2 groups whereas there was no significant difference between the groups in terms of age, LVEDD, LVESD and LAD. There was also significant difference between these 2 groups regarding NYHA class ($p= 0.033$). In the analysis carried out between the groups (according to BDI scoring system) , HbA1c values were found to be significantly higher in the group IV compared to the groups I, II and III (6,0±1.47, 6.4±0.6, 7.03±0,7, 7.6±1.23, respectively; $p< 0.01$) The results of the post hoc analysis (Group 1 vs. Group 3 $p=0.001$; Group 1 vs. Group 4 $p=0.000$; Group 2 vs. Group 4 $p=0.000$; Group 3 vs. Group 4 $p=0.017$) show the association between severity of depression and HbA1c levels.

Discussion

In this study, we found a significant association between BDI and Hb1Ac level in T2DM patients with HFrEF. There are several methods for evaluation of depression, in addition to the criteria in the Diagnostic and Statistical Manual of Mental Disorders, such as the GDS, the Center for Epidemiologic Studies Depression Scale, the Beck Depression Inventory, the Hamilton Depression Rating Scale, and the Patient Health Questionnaire 2 (12,13). In current study Beck Depression Inventory was used for assessment of the severity of depression. Depression is common in people with HF, with the prevalence ranging from 12% to 40% (14). HF duration is associated with physical impairment, resulting in significant limitations in these patients' daily life and activities. Relevant research has shown a high prevalence of depression in patients

with severe HF or a poor level of physical function (15,16). Due to the associations of depression with decreased functional performance and adverse outcomes, assessment and treatment of depression in HF is advocated. Gottlieb et al (17) demonstrated that patients classified as NYHA class III and IV were more likely to be depressed than class II patients. In current study, higher HbA1C levels, PAPs and NYHA class and presence of underlying ischemic etiology were found to be associated with higher BDI scores in patients with HF. Depression is associated with hyperglycemia in patients with DM, but the underlying mechanisms are unclear (18). Several studies observed higher rates of depression in patients with DM and tried to demonstrate the association between the presence of depressive symptoms and an increased prevalence of clinical complications of the DM. Several studies showed an increased prevalence of depression in patients with diabetes compared to a non-diabetic sex- and age-matched control group (19,20). Marcelo Papelbaum et al. found that patients with DM who displayed depression had higher HbA1C levels compared to those without depression (21). A recent study suggested that micro- and macro-vascular diabetic complications were associated with depression (22). In contrast another study showed that HbA1c levels were not associated with the presence of depression (23). but the existing literature data are still inconsistent with respect to the relationship depressive symptoms and poor glycemic control.

In current study, BDI was higher in patients with poor glycemic control and increased HbA1c levels. As increased PAPs and NYHA class were found to be associated with high HbA1c levels in T2DM patients, severity of depression can decrease with strict regulation of blood glucose levels.

Increased HbA1c levels were associated with increased PAPs and NYHA class in T2DM patients with HF. This may result in increased hospitalization rates and may probably explain the increased frequency of depression and BDI score in this group of patients.

Limitation

Our study has limitations. The sample size was relatively small, which can partially be attributed to the larger number of patients with chronic HF screened. BDI score and HbA1c levels were measured once in study patients and were not reevaluated during follow-up. In this study, we did not aim to assess the potential relationship between diabetic complications and depression.

Conclusion

This study revealed that there was an association between DM and depression; the correlation between BDI and HbA1c was significant. Patients with DM should be screened for depression and tight glucose control should be maintained. The results of this study should be further confirmed in the future-studies.

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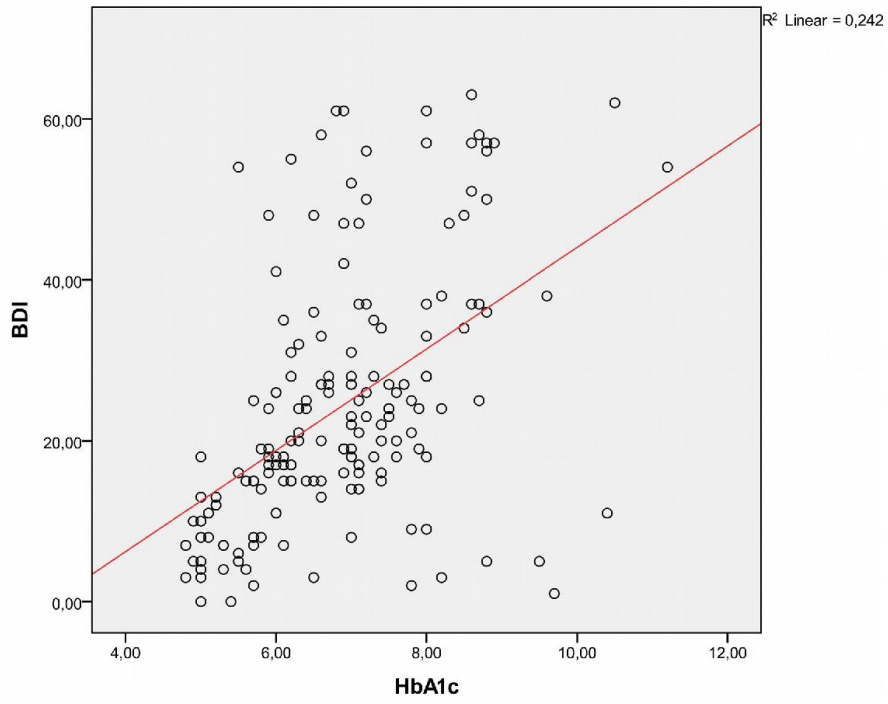


Figure 1. Scatter graphs demonstrating moderate positive correlations between the HbA1c levels and Beck Depression Inventory(BDI)

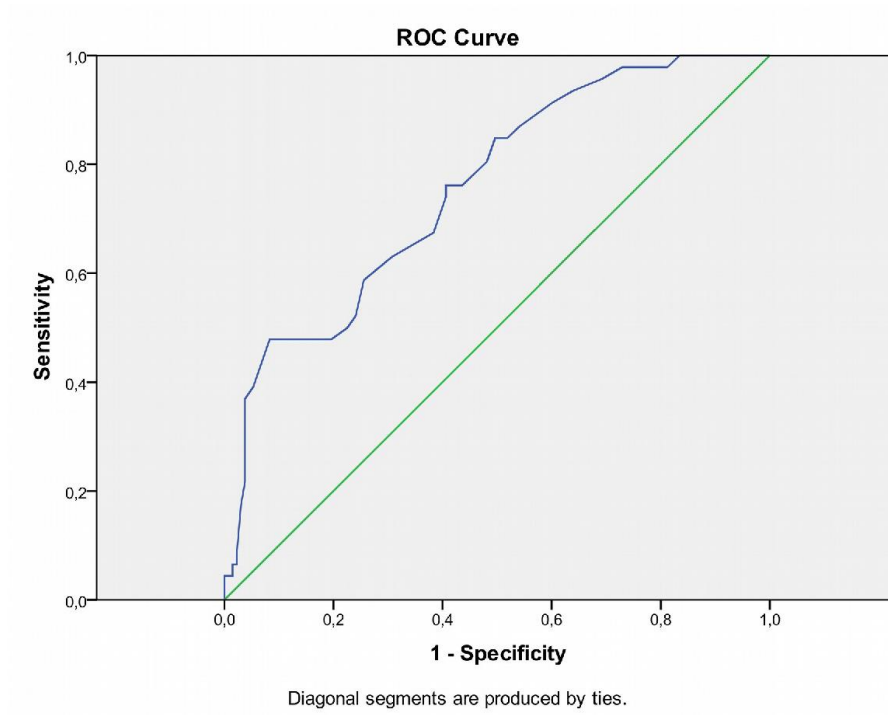


Figure 2. Receiver–operating characteristic (ROC) curve graphics to detect the best cutoff value of HbA1c in the prediction of Group IV

Table 1. Demographic, clinical, laboratory and echocardiographic characteristics of the patients according to Beck Depression Inventory

	BDI 0-13	BDI 14-19	BDI 20-28	BDI 28-63	P Value
BDI	7(4-12)	17(15-18)	25 (23-27)	47,5(36,7-56-2)	
Age	0.70±0.11	60,5(57-65)	62(56-64)	67(56-69,7)	0.007
Gender					0,232
Female	27	21	22	28	
Male	15	24	24	18	
Marital status					0.352
married(n)	33	36	37	43	
Not married(n)	9	9	9	4	
PAP	37,6+6,3	39,2+7,6	41,9+9,7	51,6+10,1	<0.001
HF etiology					
Ischemic	32	32	17	33	
Non-ischemic	10	13	29	13	
Electrocardiogram					0,439
Sinus rhythm (n)	28	32	26	27	
Atrial Fibrillation(n)	14	13	20	19	
Treatment of DM					
None	6	0	2	3	
OAD	25	32	35	34	
Insulin	11	13	9	9	
Hypertension					0.164
Yes	28	27	34	37	
No	14	18	12	9	
NYHA score					<0.001
1	19	12	8	2	
2	17	25	15	12	

	3	6	7	23	23	
	4	0	1	0	9	
Hba1c		6,0+1,4	6,4+0,	7,03+0,7	7,6+1,2	<0.001
Medication use						
Beta Blocker		28	25	34	40	0.009
Ace-i/ARB		31	27	35	43	0.003
Digoxin		10	10	12	7	0.621
Diuretics		26	24	30	37	0.052
Acetylsalicylic acid		34	35	38	43	0.197
Statin		14	23	30	17	0.001
Antidepressant Use						0.230
Yes		3	6	10	9	
No		39	39	36	37	
Echocardiography						
LVEDD		5,1(4,8-5,5)	5,2(4,8-5,9)	5,5(5,1-6,0)	6,4(5,9-6,8)	<0,001
LVSD		3,8(3,1-4,5)	3,7(3,1-4,8)	4,3(3,5-4,9)	4,9(4,6-5,5)	<0,001
LAD		4,1(3,6-4,3)	3,8(3,2-4,1)	4,0(3,6-4,3)	4,4 (4,2-4,7)	<0,001

Abbreviations: BDI, Beck Depression Inventory; HF, heart failure; DM, diabetes mellitus; OAD, oral anti-diabetics; Ace-i, Angiotensin converting enzyme inhibitors; ARB, Angiotensin reseptor blockers; PAP: Pulmonar Artery Pressure, LVEDD, left ventricular enddiastolic diameter; LVESD, left ventricular endsistolic diameter; LAD, left atrium diameter. (Continuous variables with normal distribution were expressed as mean \pm standard deviation and continuous variables without normal distribution were expressed as median (25th - 75th percentiles))

Table 2. Demographic, clinical, laboratory and echocardiographic characteristics of the patients according to HbA1c levels

	HbA1c<6,75	HbA1c>6,75	P value
BDI	16(10-25)	26,5(18-39)	<0,001
AGE	62(56-67)	63(57-68)	0,158
GENDER			
Female	47	51	0,604
Male	42	39	
MARRITAL STATUS			
Married(n)	74	74	0,87
Not Married(n)	15	16	
NYHA			
1	28	13	0,033
2	34	35	
3	23	36	
4	4	6	
HYPERTENSION			
Var	61	65	0,589
Yok	28	25	
ELECTROCARDIOGRAM			
SR	56	57	0,954
AF	33	33	
Pulmonary Pressure	Artery		
	40(35-45)	45(35-55,5)	0,002
ECHOCARDIOGRAPHY			
LVEDD	5,4(4,9-5,9)	5,7 (5,1-6,5)	0,018

LVESD	4,1(3,2-4,8)	4,6 (3,7-5,1)	0,024
LAD	4,1(3,5-4,3)	4,2 (3,7-4,5)	0,04

Abbreviations: BDI, Beck Depression Inventory; NYHA, New York Heart Association; SR sinus rhythm; AF, atrial fibrillation; PAP: Pulmonary Artery Pressure, LVEDD, left ventricular enddiastolic diameter; LVESD, left ventricular endsistolic diameter; LAD, left atrium diameter. (Continuous variables with normal distribution were expressed as mean \pm standard deviation and continuous variables without normal distribution were expressed as median (25th -75th percentiles))