Original Article

Assessment of the Relationship Between the HbA1c Level and Atherosclerosis Burden in Patients Undergoing Coronary Angiography in Farshchian Heart Center, Hamadan, Iran

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ABSTRACT

Background: Diabetes mellitus (DM) is a chronic disease which increases the risk of coronary artery disease (CAD). We sought to determine the relationship between the serum HbA1c level and the severity of CAD in diabetic patients.

Methods: This cross-sectional study enrolled 138 patients with DM who were candidated for selective coronary angiography. HbA1C was measured in all the patients. The study population's demographic information was collected through questionnaires. The data were analyzed with the SPSS software, version 16, and the descriptive statistical method was used to present the results.

Results: Selective coronary angiography was normal in 4.3% of the patients, while 26.1% had single-vessel disease, 47.8% had double-vessel disease, and 21.7% had triple-vessel disease. The serum HbA1c was less than 7% in 23.9%, between 7% and 9% in 39.1%, and more than 9% in 36.9% of the patients. A serum HbA1c level of more than 9% was reported in 42.1% of the patients with triple-vessel disease.

Conclusions: Our results indicated a relationship between the serum HbA1c level and the severity of CAD. ***(Iranian heart Journal 2018; 19(3): 46- 50)***

KEYWORDS: Coronary artery disease, Diabetes mellitus, HbA1c, Coronary angiography

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Diabetes mellitus (DM) is a term applied to a group of metabolic disorders which shares a phenotype of hyperglycemia. Various kinds of DM are developed by genetic and environmental factors, with the effective factors including decrement in insulin release, reduction in

glucose consumption, and increase in glucose production.

There are 2 major types of DM. In type I, a destruction of beta cells in the pancreas causes a defect in insulin production, and in type II, the body develops a progressive resistance to insulin, which finally causes a destruction of the pancreas beta cells and a complete defect in insulin production. In type II DM, genetic factors, obesity, and inactivity are considered the main causes.

DM causes end-stage renal disease, lower extremity non-traumatic amputation, blindness in adults, and cardiovascular diseases. With the rise in the incidence of DM in the world—reaching 382 million cases in 2013 from 30 million in 1985—it is expected to become the major cause of mortality in the future. The International Federation of Diabetes has predicted that the incidence of diabetes will amount to 592 million in 2035. Type II DM is more common than type I because of the increased rates of obesity and inactivity. In terms of the geographical distribution, type I diabetes is more common in Scandinavia and less frequent in the Pacific Ocean coasts. The Pacific Ocean islands, the Middle East, and the USA are the most common areas for type II DM.

The main cause of mortality among diabetic patients is cardiovascular disease (between 65% and 80% of all deaths). Individuals with DM are more at risk of cardiovascular disease and more likely to develop problems at a younger age. Diabetics also have a higher potential to develop silent ischemic heart disease: one-third of heart attacks in these patients occur with no known symptoms for this disease. [1] The prognosis is worse for diabetics with coronary artery disease (CAD) and a history of myocardial infarction (MI) than for healthy individuals. [1, 2]

A previous investigation on 110 diabetic patients found a direct relationship between the 2 factors of the serum HbA1c level and the duration of the development of DM and the severity of the involvement of the coronary arteries. [3] Another study on 196 individuals, comprised of 131 male and 65 female patients, concluded that the HbA1c rating system could be used as a simple method for predicting CAD. [4]

In light of the abovementioned evidence, we sought to determine the relationship between the serum HbA1c level and the severity of CAD in patients with DM.

METHODS

This cross-sectional study was conducted on 138 diabetic patients who were admitted for selective coronary angiography in Farshchian Heart Center, Hamadan, Iran, between June 2014 and May 2015.

Data were collected with a questionnaire containing questions about age, gender, the duration of DM, total cholesterol, HbA1c, smoking, blood pressure, and the number of involved coronary arteries according to selective coronary angiography.

All the statistical analyses were carried out with the SPSS software, version 16 (SPSS, Chicago, Illinois). The χ^2 test was employed for the comparison of the variables. The statistical hypothesis was 2-tailed, with a *P* value less than 0.05 considered statistically significant. The data were presented as means ± standard deviations (SDs) for the quantitative variables and frequencies and percentages for the qualitative variables.

RESULTS

The present cross-sectional study recruited 138 patients with DM, comprised of 78 (56%) males and 60 (44%) females at a mean age of 60.98±8.80 years. Thirty-nine (29%) patients were smokers. The mean cholesterol level was 192.19±18.65 mg/dL, the mean systolic blood pressure 134.37±14.25 mm Hg, and the mean development duration of DM 5.34±4.174 years. Apropos of the coronary artery involvement, 6

(4.3%) patients had none, 36 (26.1%) had single-vessel disease, 66 (47.8%) had double-vessel disease, and 30 (21.7%) had triple-vessel disease.

The serum HbA1c level was less than 7% in 33 (23.9%) patients, 45.5% of whom had single-vessel disease, 45.5% had double-vessel disease, and 9% had triple-vessel disease. The serum HbA1c level was between 7% and 9% in 34 (39.1%) patients, 5.6% of whom had no vessel involvement, 22.2% had single-vessel disease, 61.1% had double-vessel disease, and 11.1% had triple-vessel disease. The serum HbA1c level was over 9% in 51 (36.9%) patients, 5.9% of whom had no involved vessels, 17.6% had single-vessel disease, 35.3% had double-vessel disease, and 41.2% had triple-vessel disease.

As is depicted in Table 1 the frequency of the diabetic patients with triple-vessel disease was greater among those with a serum HbA1c level higher than 9% than that in the other groups; however, there was no significant difference in the HbA1c level regarding the number of involved vessels (*P*=0.089).

Table 1. Frequency distribution of the different levels of HbA1c according to the number of involved coronary artery vessels in the diabetic patients

Number of Involved Vessels	HbA1c Level		
	<7%	7%–9%	>9%
0	0	3(5.6)	3(5.9)
1	15(45.5)	12(22.2)	9(17.6)
2	15(45.5)	33(61.1)	18(35.3)
3	3(9)	6(11.1)	21(41.2)
Total	33(100)	54(100)	51(100)

Table 2 shows that 96 (69.5%) patients had the coronary involvement of at least 2 vessels on angiography. These subjects were significantly older and had a higher duration of DM than their counterparts. There were no significant differences between the groups vis-à-vis blood pressure, total cholesterol, gender, and smoking.

Table 2. Comparison between the diabetic patients in terms of the coronary involvement of a single vessel and the coronary involvement of at least 2 vessels

Variable	< 2 Vessels	≥ 2 Vessels	*P*
	Number (%)	Number (%)	
Age, y			
<60	21(40.4%)	31(59.6%)	0.048
≥60	21(24.4%)	65(75.6)	
Sex			
Male	27(34.6%)	51(65.4%)	0.224
Female	15(25%)	45(75%)	
Smoking			
Yes	66(66.7%)	33(33.3%)	0.238
No	30(76.9%)	9(23.1%)	
Diabetes duration			
<5	61(67%)	30(33%)	0.031
5-10	21(63.6%)	12(36.4%)	
>10	14(100%)	0(0)	
Cholesterol			
<200	15(35.7%)	27(28.1%)	0.373
≥200	27(64.3%)	69(71.9%)	
Blood pressure			
<140/90	51(70.8%)	21(29.2%)	0.735
≥140/90	45(68.2%)	21(31.8%)	

DISCUSSION

The HbA_1c level is one of the most important items in diabetic patients when it comes to controlling blood glucose and treating cardiovascular disease. [3-5] A relationship has been previously demonstrated between the HbA_1c level and the severity of coronary artery involvement in diabetic patients; therefore, HbA_1c can be used as a predictor of the cardiac side effects caused by DM. Patel et al [5] reported that their patients with serum HbA_1c levels of more than 9% had more triple-vessel involvement than their other patients.

According to our findings, the diabetic patients with the involvement of 2 or 3 coronary vessels on angiography were significantly older than their counterparts. This result, however, has not been reported by other studies. [6, 7]

In their study, al-Nozha et al [8] found that their diabetic female patients had a higher incidence of cardiovascular disease. Rivera and colleagues [9] reported that the severity of coronary artery involvement was less among their nondiabetic female patients than in their

male counterparts. In contrast, we and Saleem et al [3] found no significant statistical relationship between gender and the severity of coronary artery involvement in diabetic patients.

In the current study, the findings concerning the relationship between smoking and the severity of the involvement of the coronary arteries are concordant with those reported by Ashraf et al, [7] Ertem et al, [10] and Rasoul et al., [11] who reported no relationship in this regard.

Saleem et al [3] and Singer et al [12] reported a relationship between the duration of DM and the severity of coronary artery involvement. According to our study, the number of involved coronary arteries increased in tandem with an increase in the development duration of DM. All the patients with a more than 10-year history of DM development in the current study had double- or triple-vessel involvement on selective coronary angiography. Hence, the duration of DM development can be deemed an effective factor with respect to the severity of coronary artery involvement. [12]

In their respective studies, Saleem et al [3] and Ayhan et al [13] found no relationship between the total cholesterol level and the severity of the involvement of the coronary arteries. These findings do not chime in with the results of some other investigations, however. This discrepancy is probably due to the potent impact of DM on triglycerides and high-density lipoproteins compared with total cholesterol.

Our results showed no statistically significant relationship between blood pressure and the severity of coronary artery involvement, which does not tally with the results of a study by Karki et al. [6]

Overall, given the significance of the DM-related cardiovascular disease and its resultant morbidity and mortality, more attention should be paid to the control and prevention of DM. Our results underscored the role of HbA1c as an independent factor in predicting cardiovascular disease insofar as triple-vessel disease on selective coronary angiography was more frequent in our patients whose HbA1c levels exceeded 9%.

Conflict of Interest

The present study was supported by the Ethics Committee of the Medical Faculty of Hamadan University of Medical Sciences. All the contributing authors declare no conflict of interest.

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