

The relationship between HbA1c and cardiovascular events in diabetic patients with coronary angioplasty: A cross-sectional study

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ABSTRACT

Introduction: Re-establishment of coronary artery blood flow in diabetic patients has always been a controversial issue in the treatment of cardiovascular diseases. Due to the importance of this issue and the increase in mortality due to heart disease, the present study was performed to determine the relationship between HbA1C and cardiovascular events in diabetic patients with coronary angioplasty referred to Imam Khomeini Hospital in Ahvaz. **Methods:** This was a descriptive cross-sectional study in which 114 patients were enrolled in a census study that was followed for 3 to 6 months. Data was collected by a checklist and by the researcher using the patient's medical record. Then it was analyzed by SPSS 22 software and descriptive statistics. **Results:** There was no significant relationship between age, gender, family history of diabetes, family history of heart disease, duration of diabetes, stroke, myocardial infarction, and heart failure with HbA1c ($P > 0.05$). However, there was a significant relationship between the type of coronary angioplasty, hypertension, and heart block with HbA1c ($P < 0.05$). **Conclusion:** According to the results of this study, there was a significant relationship between the type of coronary angioplasty, hypertension, and heart block with HbA1c; thus HbA1c should be better controlled in diabetic patients who decide to have angioplasty.

Keywords: Angioplasty, balloon, cardiovascular diseases, coronary, diabetes

Introduction

Type 2 diabetes is highly prevalent in Iran and the world and this disease is increasing every year. The disease has several microvascular and macrovascular complications that lead to dysfunction and increase their annual mortality.^[1]

Cardiovascular disease is one of the most important complications of diabetes, which leads to an increase in mortality per year; thus people with diabetes live an average of 6 years less than people

without diabetes, and in case of heart disease, this rate leads to 12 years reduction.^[2-4]

HbA1c has been accepted as an indicator for measuring mean glucose in the last 3 months to assess the control status of diabetic patients. This index also indicates impaired glucose metabolism such as impaired glucose tolerance or metabolic syndrome.^[5] The effect of hyperglycemia on increased stress due to cardiovascular events on HbA1c is negligible.^[6]

The effect of elevated HbA1c with cardiac events is less well known, especially in patients undergoing coronary angioplasty. Recently, chronic hypoglycemia, assessed by HbA1c, has shown to be associated with increased complications of myocardial infarction, and studies have

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suggested that increased HbA1c is a preventative factor in cardiac complications.^[7]

But in a number of studies, there has been an inverse relationship between HbA1c levels and cardiovascular events. Considering the contradictions that have a predictive value of HbA1c in cardiovascular complications of diabetic patients and considering that no research has been done on these complications in patients with coronary angioplasty in Iran, in this study, HbA1c and cardiovascular complications and vascular examination was performed in diabetic patients undergoing coronary angioplasty.

Materials and Methods

The present study was a descriptive cross-sectional study that was conducted in 2020. The study population consisted of all patients with diabetes who referred to Imam Khomeini Hospital in Ahvaz, Iran, then underwent elective angioplasty due to clogged arteries. 114 patients were selected as the sample. Inclusion criteria included all diabetic patients whose diabetes was confirmed by an internal medicine specialist and who underwent elective angiography and angioplasty. Patients who falsely showed high HbA1c in the tests were excluded from the study. These include patients with severe iron deficiency anemia, severe hypertriglyceridemia greater than 1700 mg/dl, hyperbilirubinemia greater than 20 mg/dl, and severe uremia. So patients with low serum albumin, alcoholism, drug addiction, salicylate poisoning, and patients who taking vitamin C daily for three months because falsely high HbA1c was excluded from study. Patients with conditions such as chronic blood loss, hemolytic anemia, and splenomegaly, which can also lead to decreased HbA1c, were excluded from the study.

The necessary information was completed by a checklist and using their medical records. The checklist included demographic information (gender, age) as well as research variables such as blood pressure, diabetes, stroke, heart attack, heart failure, heart block, and HbA1c. Diabetic patients were divided into three groups: HbA1c less than 6, HbA1c in 6–8 range, and HbA1c more than 8; and angioplasty was divided into two groups: simple and complex. The simple group refers to the use of only one stent in a patient's vein, while the complex group refers to angioplasty that requires more than one stent. Finally, after angioplasty, patients were evaluated for cardiac events (such as myocardial infarction or unstable angina attack or ischemic events such as stroke) between 3 and 6 months later by telephone or in person.

Independent *t* test and Chi square were used to describe and analyze the data using SPSS Statistics Version 22 at the significance level of 0.05.

Results

Based on the results obtained from [Table 1], out of 114 patients, the type of coronary angioplasty was simple in 76 patients (66.7%)

and complex in 38 patients (33.3%). There was a significant relationship between the type of coronary angioplasty and HbA1c ($P < 0.05$).

Table 1: Relation between HbA1c with type of angioplasty

	<6		Between 6 and 8		More than 8		Total	
	n	%	n	%	n	%	n	%
Simple	35	64.8	32	82.1	9	42.9	76	66.7
Complex	19	35.2	7	17.9	12	57.1	38	33.3
Total	54	47.4	39	34.2	21	18.4	114	100

$P=0.008$ simple(use of one stent for type 1 lesion)and complex(use of multiple stents for complex anatomy type 2 or higher lesion).n=number, p=percent,* means significant

Based on the results obtained from [Table 2], out of 114 subjects, 27 (23.7%) had a family history of diabetes. There was no significant relationship between family history of diabetes and HbA1c ($P > 0.05$).

Table 2: Relation between HbA1c level with family history of diabetes

	<6		Between 6 and 8		More than 8		Total	
	n	%	n	%	n	%	n	%
Yes	14	25.9	6	15.4	7	33.3	27	23.7
No	40	74.1	33	84.6	14	66.7	87	76.3
Total	54	47.4	39	34.2	21	18.4	114	100

$P=0.257$ n=number, p=percent,* means significant

Based on the results obtained from [Table 3], out of 114 patients, 13 (11.4%) had a heart attack, 12 (10.50%) had heart failure, and 14 (12.28%) had heart block. There was no significant relationship between myocardial infarction and heart failure with HbA1c ($P > 0.05$). There was a significant relationship between heart block and HbA1c ($P < 0.05$).

Table3: Relation between HbA1c with clinical outcome 6 months after elective angioplasty

	<6		Between 6 and 8		More than 8		Total		P
	n	%	n	%	n	%	n	%	
Heart Attack	5	38.5	4	30.8	4	30.8	13	11.40	0.47
Heart Failure	5	41.7	2	16.7	5	41.7	12	10.50	0.073
Heart Block	3	21.4	5	35.7	6	42.9	14	12.28	0.024

Discussion

Kashi^[8] in a study in Iran, examined 1021 diabetic patients. The mean age of patients was 54 years and the duration of diabetes was 8 years. The results showed that the years of diabetes mellitus had the greatest effect on cardiovascular complications in these patients and the effect of HbA1c on cardiac complications after hypertension, low ejection fraction, and smoking, which was not consistent with the results of the present study in terms of mean age (40 to 50 years) and duration of diabetes (less than one year). Lack of alignment can be due to differences in the city under study and people's lifestyles. Also, the two studies were consistent in terms of the significant relationship between HbA1c and blood pressure.

Bagheri^[9] in a study in Iran, examined 47 patients with myocardial infarction. The patients were divided into two groups: HbA1c less than 6.2 and HbA1c more than 6.2. HbA1c more than 6.2 mortality was not significantly different but the incidence of heart failure and heart block was increased which was not consistent with the results of the present study in terms of association of HbA1c with heart failure; but two studies were consistent in terms of significant association of HbA1c with heart block.

In the Cronberg study in the United States, 1687 patients with diabetes were cohorted. The results showed that there was a moderate-to-moderate relationship between cardiovascular events and HbA1c levels.^[10] They are consistent with heart failure and myocardial infarction.

Ziabakhsh *et al.*^[11] in a study in Mazandaran showed that out of 135 patients, 83 were male and 88 (65%) were non-diabetic. The mean age was 52 with an age range of 33 to 78 years. Optimal HbA1c levels were seen in 48 patients (35.5%) non-diabetic and in 24 patients (17%) diabetic ($P > 0.05$). Wound infection ($P < 0.05$), low output ($P < 0.05$), need for intra-aortic pump balloon ($P < 0.05$), cerebrovascular events after coronary artery bypass grafting ($P < 0.05$), in non-diabetic with high HbA1c level was higher than non-diabetic patients. The duration of hospitalization in different groups did not show a difference ($P > 0.05$) which is not comparable to the present study due to differences in study objectives; but the final result of the two studies was that cardiac procedures including coronary artery bypass grafting and coronary angioplasty was significantly associated with HbA1c, which was consistent with the present study.

Seyed Mohammadzadeh *et al.*^[12] in a study showed that there was a statistically significant relationship between HbA1c and the severity of coronary artery involvement ($P = 0.002$). Also there was a statistically significant relationship between coronary artery involvement and family history ($P = 0.003$). In this study, in order not to interfere with gender in the analysis of the relationship between smoking and coronary artery disease, the analysis was performed on men and women independently but no significant results were observed ($P = 0.160$ for men and $P = 0.281$ for women). The results of the present study are consistent.

Conclusion

According to the results of this study, there was a significant relationship between the type of coronary angioplasty, hypertension and heart block with HbA1c, so appropriate measures and strategies should be taken in the community to control blood pressure and given that heart disease is other than that. It is a group of chronic diseases that are affected by lifestyle, so teach the correct lifestyle that reduces diabetic and cardiovascular problems. It also provided better control of HbA1c in diabetic patients who decided to have angioplasty.

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Conflicts of interest

There are no conflicts of interest.

References

1. Malik S, Wong ND, Franklin SS, Kamath TV, L'Italien GJ, Pio JR, *et al.* Impact of the metabolic syndrome on mortality from coronary heart disease, cardiovascular disease, and all causes in United States adults. *Circulation* 2004;110:1245-50.
2. Jesudason DR, Dunstan K, Leong D, Wittert GA. Macrovascular risk and diagnostic criteria for type 2 DM. *Diabetic Care* 2003;26:485-49.
3. Jeffcoute S. Diabetes control and complications: The role of glycated haemoglobin, 25 years on. *Diabet Med* 2004;21:657-65.
4. Giugliano D, Bellastella G, Longo M, Scappaticcio L, Maiorino MI, Chiodini P, *et al.* Relationship between improvement of glycaemic control and reduction of major cardiovascular events in 15 cardiovascular outcome trials: A meta-analysis with meta-regression. *Diabetes Obes Metab* 2020;22:1397-405.
5. Lynch M, Gammayz M, Lamb P. Acute Myocardial infarctin in diabetic patients in thrombolytic era. *Diabetic Med* 1994;11:162-5.
6. S Hadjadj, D Coisne, G Mauco, S Ragot, F Duengler, P Sosner, *et al.* Prognostic value of admission plasma glucose and HbA in acute myocardial infarction *Diabet Med.* 2004;21:305-10. doi: 10.1111/j.1464-5491.2004.01112.x.
7. Garber AJ, Handelsman Y, Grunberger G, Einhorn D, Abrahamson MJ, Barzilay JL, *et al.* Consensus statement by the American Association of Clinical Endocrinologists and America College of Endocrinology on the comprehensive type 2 diabetes management algorithm-2020 executive summary. *Endocr Pract* 2020;26:107-39.
8. Kashi Z, Bahar A, Akha O, Sharif F, Kosaryan M, Jalalian R, *et al.* Ischemic Heart Disease and Related Factors in Patients with Diabetes Mellitus Type II. *J Mazandaran Univ Med Sci* 2015;25:9-16.
9. Bagheri B, Varshochi F, Golshani S, Mokheri V, Zahtab M, Khalilian A. Investigation the correlation between HbA1C with monthly mortality and morbidity of ST Elevation myocardial infarction. *J Mazandaran Univ Med Sci* 2012;22:38-95.
10. Kranenburg G, van der Graaf Y, van der Leeuw J, Nathoe HMW, de Borst GJ, Kappelle LJ, *et al.* The relation between HbA1C and cardiovascular events in patients with type 2 diabetes with and without vascular disease. *Diabetes Care* 2015;38:1930-6.
11. Tabary SHZ, Hassan MB. The association between HbA1c level and complications of bypass surgery in Mazandaran province in 2009. *J Mazandaran Univ Med Sci* 2010;20:16-20.
12. Mohammadzad MS, Khademvatani K, Feizi A, Shakibi A, Rostamzadeh A, Barandoozi M. Evaluation of the relationship between serum hbA1c level and severity of cad in diabetic patients. *The Journal of Urmia University of Medical Sciences*, 2016;26:865-71.