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Original Article

Cardiovascular events in patients with over 10 years history of type 2 diabetes mellitus

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ABSTRACT

Background: Diabetes is one of the concerns of today's public health and patients with type 2 diabetes are at increased risk of death due to cardiovascular diseases. The aim of this study was to evaluate the prevalence of cardiovascular diseases in patients with over 10 years history of type 2 diabetes mellitus referred to the Sanandaj Diabetes Clinic.

Methods: In this study, 400 patients with type 2 diabetes who had over 10 years history of diabetes were selected and the required information was prepared based on taking their history and files. Finally data were analyzed using T-test, Chi-square and Fisher test methods.

Results: In this the mean duration of diabetes was 14.59 ± 4.07 years. 95.25% of patients had dyslipidemia. The frequency of history of cardiovascular events was 78.25%. 12.25% of patients had a history of ischemic heart disease and 82.75% had a history of high blood pressure. There was a significant relationship between the incidence of cardiovascular events with hypertension, HDL level and family history of early cardiovascular disease ($p < 0.05$).

Conclusion: The high risk of cardiovascular events in diabetic patients it strongly emphasizes the need for quick and serious approaches to prevent cardiovascular events in diabetic patients.

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1. Introduction

Diabetes mellitus (DM) is the most common metabolic disorder in the body, in which the body's ability to use of glucose is reduced, followed by increased levels of glucose, which is called hyperglycemia. There are two main types of DM: type 1 and type 2. In type 1 diabetes, the destruction of beta cells in the pancreas leads to defective insulin production, but in type 2 diabetes, there is a progressive body's resistance to insulin, which may ultimately leads to the destruction of Beta cells of the pancreas and leads to a complete deficiency of insulin production [1]. Generally, type 2 diabetes is the most common type and accounts for more than 90% of cases of diabetes. It is estimated that the prevalence of the disease will reach to 350 million patients in 2025. Although the incidence of type 1 and type 2 diabetes is increasing in the world, but it

is expected that the rate of increase in type 2 be higher, which may be due to a change in lifestyle that has led to an increase in the incidence of obesity and a decrease in physical activity. Both genetic and environmental factors play a role in the incidence of type 2 diabetes, which may indicate a different outbreak in different parts of the world [2]. Of every 120 Iranians, one person is diagnosed with DM and half of the cases are unaware of their illness. Currently, the number of diabetic patients in Iran is estimated at 1.5 million [3].

With uncontrol of diabetes, various complications be found in various tissues, including coronary and peripheral vascular disease, nephropathy, retinopathy, cardiomyopathy and neuropathy [4]. Cardiovascular disease (CVD) is the leading cause of disability and mortality in people with diabetes [5]. So that the diabetes increases the risk of coronary artery disease 2 to 4 times, and 60 to 80% of diabetics die from CVD and have the largest share of direct and indirect costs of diabetes [6,7]. The mortality rate of CVD in the United States is 1.7 times higher in diabetic adults (over 18 years of age) than in non-diabetics, which is due to an increased risk of

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stroke and infarction [8]. Many studies have reported the association between microalbuminuria and clinical proteinuria with increased mortality in patients with type 2 diabetes, which was largely due to CVD [9–12]. Some studies have suggested that the prevalence of CVD in diabetics even is higher than the general population. In a study conducted by Norhammar et al., it was found that 66% of patients who experience MI for the first time have evidence of impaired glucose tolerance or frank diabetes [13–15]. Diabetes accelerates the arteriosclerosis process, causing multiple cardiovascular involvement and more severe and widespread illnesses. Also, increasing blood glucose can be a toxic factor for myocardial cells and disrupt them. Common illnesses associated with type 2 diabetes, such as high blood pressure and dyslipidemia, are a known risk factor for CVD, and furthermore diabetes is an independent risk factor. The risk of these diseases increases in both types of diabetes 1 and 2 even at early ages [16]. Even low increase in levels of blood sugar can greatly increase the risk of CVD. In people with type 2 diabetes, due to insulin resistance, high blood sugar can lead to coronary artery stenosis and increased risk of CVD many years before diabetes diagnosis, so control of diabetes and risk factors of CVD can play a role in reducing the risk of developing these diseases [17].

According to the importance of diabetes, as well as the importance of cardiovascular complications in these patients and the role of controlling their related risk factors in reducing the incidence of these complications, and considering that there is still no study on the prevalence of cardiovascular complications and related risk factors in the Kurdistan province and especially in Sanandaj city, The aim of this study was to investigate CVD in patients referred to Sanandaj Diabetes Clinic in order to estimate the prevalence of these complications for better and more control.

2. Materials and methods

In this study, after receiving approval from the ethics committee of Kurdistan University of Medical Sciences, patients with type 2 diabetes who had a over 10 years history of diabetes mellitus referred to the Sanandaj Diabetes Clinic were considered as the study population. Pregnancy, corticosteroid use, Cushing's syndrome or other types of secondary diabetes, liver failure, and type 1 diabetes considered as exclusion criteria. Eventually, 400 patients were included in the study. After describing all the stages of the study for patients and obtaining written consent from them, their history were taken and their profile was reviewed. Patients' characteristics including name, age, gender, education level, smoking, familial history of CAD, duration of diabetes, and type of treatment were recorded in prescriptive forms according to their history and profile. Blood pressure of the patients was measured by one person, by same barometer and with same method, and if the measured blood pressure was above 140/90, the hypertension was considered and recorded in the form. History of coronary artery disease, confirmed by coronary angiography, heart stroke, coronary angioplasty (with or without stent), and ischemic heart disease approved with angiography have been asked as serious complications of CVD and recorded in the form. Dyslipidemia was evaluated by referring to the patient's previous lab results, which was considered as positive for men with $TG \geq 150$, $LDL \geq 100$ and $HDL < 40$ and $HDL < 50$ in women. Family history of early coronary artery disease was considered as positive in the presence of a history of ischemic heart disease in family grade 1 (parents, brother and sister) in females less than 55 years old and in males under 45 years old. Cigarette Smoking was reviewed based on current smoker (using cigarette while they entered the study), Ex smoker (non-smokers who have smoked more than 100 Cigarettes in their lifetime and have gived up smoking 1 year ago) and non smoker (non-smokers

who have smoked less than 100 cigarettes in their lifetime).

Data was entered in the STATA software (version 12.1; StataCorp LP, Texas, USA). Descriptive variables were measured using descriptive statistics including absolute and relative frequency, mean and standard deviation. Analytical variables were analyzed using T-test, Chi-square and Fisher methods.

3. Results

This study was a descriptive-analytic study. Totally, 400 patients were evaluated, of which 74 cases (18%) were male and 326 cases (82%) were female. The mean age of patients was 61.36 ± 10.22 years old and the mean duration of diabetes was 14.59 ± 4.07 years. Also, the illiterate group were included the largest number of patients with the prevalence of 259 cases (65%). Of the subjects, 57.5% were treated with oral tablets. Most of the patients (78.5%) were non smoker and family history of early coronary artery disease was seen in only 14% of patients. Totally, 95.25% of patients had dyslipidemia, which 87.25% of all patients had high LDL history, 90.75% of them had low HDL history and 84.25% had high TG history. The frequency of CVD was 78.25% and only 5.75% of patients had a history of CABG and 3.75% had a history of angioplasty. 12.25% of patients had a history of ischemic heart disease and 82.75% had a history of high blood pressure (Table 1).

According to the results of this study, there was no significant relationship between CVD with gender, age, duration of diabetes and smoking ($P = 0.6$, $P = 0.064$, $P = 0.6$ and $P = 0.09$, respectively) But there was a significant relationship between the history of CVD with family history of early coronary artery disease, HDL profile and history of hypertension ($P = 0.0001$, $P = 0.013$, $P = 0.01$, respectively), so that the prevalence of CVD was higher in patients with positive family history and low HDL, while there was no statistically significant relationship between CVD with LDL and TG status ($p = 0.072$ and $p = 0.621$, respectively) (Table 2).

4. Discussion

Diabetes is a serious public health concern [18]. According to the studies, patients with type 2 diabetes are at increased risk of death due to cardiovascular diseases [19,20]. The aim of this study was to evaluate the prevalence of cardiovascular diseases in type 2 diabetic patients with over 10 years history of diabetes referred to the Sanandaj Diabetes Clinic.

In this study, 400 patients were studied, of which 82% were female and 18% were male. The mean age of the subjects was 61.36 ± 10.22 years and the mean duration of diabetes was 14.59 ± 4.07 years. In the case of education, illiterate patients was the most frequent cases (65%) and those with university education were allocated the lowest frequency (1.2%). In this study 21.75% of the subjects had a history of CVD. 3.75% had history of angioplasty, 5.75% had history of CABG and 12.25% had history of ischemic heart disease.

The analytical results of this study showed that the prevalence of cardiac events was higher in men (25.6% versus 20.8%), but this relationship was not statistically significant ($p > 0.05$). It should be noted that in this study, the frequency of women was higher than men. The relationship between sex and CVD has been proven and men are at increased risk for these diseases due to genetic differences, hormonal differences, and etc. between the two gender [21]. In this study, similar to others, the prevalence was higher in men. But it should be noted that in this study, patients had diabetes and complications have been studied in this group and diabetes, in its turn, is also an important risk factor for CVD that its severity has a significant effect on complications. In this study, the prevalence of CVD in the age group of more than 55 years old was higher than the

Table 1
Status of descriptive Variables.

Variable		Frequency (%)	Confidence Interval
Gender	Male	74 (18)	14 - 21
	Female	326 (82)	78 - 85
	Total	400 (100)	
Education Status	Illiterate	259 (65)	60.3 – 69.7
	Elementary School	91 (22.8)	18.7 - 27
	Junior School	19 (4.7)	2.6 – 6.8
	High School	27 (6.3)	3.8 – 8.6
	University	4 (1.2)	0.001 – 1.9
	Total	400 (100)	
Treatment Type	Tablet	230 (57.5)	52.6 – 62.4
	Insulin	18 (4.5)	2.4 – 6.5
	Tablet & Insulin	150 (37.5)	32.6 – 42.2
	Diet	2 (0.5)	-0.1 – 1.2
	Total	400 (100)	
Smoking Status	Ex Smoker	28 (7)	4.5 – 9.5
	Current Smoker	58 (14.5)	10.6 – 17.5
	Non Smoker	314 (78.5)	74.8 – 82.6
	Total	400 (100)	
Familial History of Early Coronary Artery Disease	Positive	56 (14)	10.9 – 17.7
	Negative	344 (86)	82.2 - 89
	Total	400 (100)	
Dislipidemia	Positive	381 (95.25)	93.1 – 97.3
	Negative	19 (4.75)	2.6 – 6.8
	Total	400 (100)	
High LDL	Positive	349 (87.25)	84 – 90.5
	Negative	51 (12.75)	9.4 – 15.9
	Total	400 (100)	
Low HDL	Positive	363 (90.75)	87.7 – 93.6
	Negative	37 (9.25)	6.3 – 12
	Total	400 (100)	
High TG	Positive	337 (84.25)	80.7 – 87.8
	Negative	63 (15.75)	12.1 – 19.2
	Total	400 (100)	
Cardiovascular Events	Positive	87 (21.75)	17.4 – 25.4
	Negative	313 (78.25)	74.5 – 82.5
	Total	400 (100)	
History of CABG	Positive	23 (5.75)	3.4 – 7.9
History of Angioplasty	Negative	377 (94.25)	92 – 96.5
	Total	400 (100)	
	Positive	15 (3.75)	1.8 – 6.4
History of Ischemic Cardiac Disease	Negative	385 (96.25)	94.1 – 97.9
	Total	400 (100)	
	Positive	49 (12.25)	10.4 – 17.2
History of Hypertension	Negative	351 (87.75)	82.7 – 89.5
	Total	400 (100)	
	Positive	49 (12.25)	10.4 – 17.2
History of Hypertension	Positive	331 (82.75)	79.2 – 86.6
	Negative	69 (17.25)	13.3 – 20.7
	Total	400 (100)	

group of under 15 years old (23.8 vs. 15), but this relationship was not statistically significant ($p > 0.05$). The impact of age has been accepted as a major risk factor for CVD that older people are at a higher risk for CVD [22]. But in this study, despite the high prevalence of CVD in older people, the relationship was not significant which suggests that the age was not the only effective factor in these patients. In the studies of Heshmati et al. And Lee et al. there was no statistically significant relationship between age and sex with the prevalence of CVD, which is consistent with the results of our study [23,24]. In this study, the most frequent type of diabetes

therapeutic method was treatment with tablet (57.5%) and the lowest frequency was allocated to diet therapy (0.5%). Blood glucose management and diabetes treatment with tablet is much easier than any other treatment approaches, and compliance with a diet, especially at elder ages, is difficult, so the physicians' priority to diabetes treatment is tablet prescription. In the present study, most of the subjects (78.5%) were Non Smoker and 14.5% were in the Current Smoker group and 7% in the Ex Smoker group and the prevalence of CVD was the highest in the Current Smoker group with a 34.4% prevalence, but there was no statistically significant

Table 2
Comparison of the rate of cardiovascular events with studied Variables.

Cardiovascular Events Variable		Positive Frequency (%)	Negative Frequency (%)	χ^2	P-Value
Gender	Male	19 (25.6)	55 (74.4)	0.27	0.60
	Female	68 (20.8)	258 (79.2)		
Age	Under 55 y/o	15 (15)	86 (85)	3.44	0.064
	Above 55 y/o	71 (23.8)	228 (76.2)		
Duration of Diabetes	Under 15 Years	56 (19.8)	226 (80.2)	1.61	0.604
	Above 15 Years	30 (25.4)	88 (74.6)		
History of Smoking	Ex Smoker	6 (21.5)	22 (78.5)	4.80	0.09
	Current Smoker	20 (34.4)	38 (65.5)		
	Non Smoker	61 (19.4)	253 (80.6)		
Familial History of Early Coronary Artery Disease	Positive	25 (44.6)	31 (55.4)	18.46	0.0001
	Negative	62 (18)	282 (82)		
Low HDL	Positive	84 (23)	279 (77)	6.19	0.013
	Negative	3 (8)	34 (92)		
High LDL	Positive	79 (22.6)	270 (77.4)	3.22	0.072
	Negative	8 (15.6)	43 (84.4)		
High TG	Positive	74 (21.9)	263 (78.1)	0.24	0.621
	Negative	13 (20.6)	51 (79.4)		
History of Hypertension	Positive	80 (24.1)	253 (75.9)	62.3	0.01
	Negative	7 (10.1)	62 (89.9)		

difference ($p > 0.05$). There was no significant relationship between smoking and CVD in Heshmati et al. study, which was consistent with the results of our study [24]. Cigarette smoking is one of the most important risk factors for heart diseases. The absence of a meaningful relationship in this study does not mean that smoking does not have an effect on cardiovascular events, but it means that this factor can not alone be the main cause of CVD. In our study, 14% of the subjects had a positive family history of early coronary artery disease and the incidence of CVD was higher in these cases (44.6%), which was statistically significant ($p = 0.0001$). People with a positive family history of heart disease are definitely more susceptible to have a genetic predisposition to CVD, and they need to be continuously monitored, treated and take medications. 95.25% of subjects had dyslipidemia with 87.25% history of high LDL, 90.7% of low HDL and 84.25% of high TG, and there was a significant relationship between HDL and CVD and the prevalence of CVD was higher in people with a low HDL profile ($P = 0.013$), but there was no significant relationship between CVD with LDL and TG serum levels, however, the incidence rate was high in patients with high LDL and TG serum levels ($p > 0.05$). Garvey et al. Deeg et al. and Goldberg et al. In their studies demonstrated that in patients with type 2 diabetes, LDL concentrations may not increase, but for each LDL-concentration, patients with diabetes totally have increased LDL-particles [25–27](111–113). HDL remove the excess cholesterol from atherosclerotic plaque cells and decreasing its concentration in diabetes can have harmful effects on cholesterol content in vascular walls [28].

The results showed no significant relationship between the duration of diabetes and cardiovascular events ($p > 0.05$). However, the prevalence of CVD was higher in people with more than 15 years history of DM (25.4%). It should be noted that most of the subjects were in the group of less than 15 years history. It is clear that long-term diabetes history increases the risk of CVD due to the mentioned mechanisms of its link with CVD, because the body is more exposed to destructive pathologic conditions for a long time. But the non-significance relationship of this increase in prevalence reflects that the long-term duration of diabetes is not definitive determinant for cardiovascular events, and the severity and the rate

of complications leading to CVD are also determinative, and may occur in short term. 82.75% of the subjects had a history of hypertension and the prevalence of CVD was higher in this group (24.1%), which is statistically significant ($p = 0.01$). In a cohort study of 12550 adults, it was found that the progression of type 2 diabetes in hypertensive patients was 2.5 times more than that of normotensive subjects [29]. Also, diabetes is associated with an increase in the prevalence of hypertension, which indicates the coexist of these two diseases with each other [30,31]. Therefore, as has been proven, hypertension is also a risk factor for cardiovascular diseases and increases their prevalence.

5. Conclusion

According to the results of this study, the risk of cardiovascular events is higher in diabetic patients with a history of hypertension, low HDL and a family history of early coronary artery disease. Therefore, these risk factors in patients with diabetes should be controlled to prevent the occurrence of cardiovascular events as much as possible. Using the results of this study, it is possible to determine the necessary treatment approaches for better control of the disease in diabetic patients and can be used in health care centers. Further studies are needed to better understand of the relationship between these two diseases in order to make a more accurate decision to reduce the prevalence of cardiovascular events. Therefore, studies in larger statistical population, different age groups and in relation to different effective factors are recommended.

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