ORIGINAL ARTICLE

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Analysis of the Type 2 Diabetic Patients Followed in a University Clinic

ABSTRACT

Objective: The aim of present study was to determine the effects of factors to diabetic regulation; such as, awareness of the disease, compliance with treatment, awareness of HbA1c target, in T2DM patients whom followed up in our clinic.

Methods: Patients with T2DM were enrolled to this retrospective study. Patient's data were obtained and recorded from institutional database. As well as blood pressure, anthropometric measurements, physical examination signs, and laboratory parameters were recorded. Study population grouped into two according to HbA1c level; well-regulated T2DM group with a HbA1c lower than 8% and poorly-controlled T2DM group with a HbA1c 8% or greater.

Results: A total of 150 patients with T2DM (72 men and 78 women) enrolled. Waist circumference, body mass index, duration of diabetes, LDL-cholesterol , total cholesterol, triglyceride and serum creatinine were significantly lower in well-controlled compared to poorly-controlled diabetic subjects (all $p<0.05$). Rate of well-regulated subjects was higher in patients living in urban compared to subjects living in rural area ($p=0.01$). Diabetic regulation rate was significantly higher in patients acknowledge the diabetic medications, in self-monitoring blood glucose, in subjects aware of HbA1c target, and free of diabetic complications; neuropathy, nephropathy, and diabetic foot (all $p<0.05$).

Conclusions: Striking result of present study is that most important factors associated with better diabetic control were self monitoring of blood glucose, awareness of treatment target and acknowledgement of the diabetic medications; which all could be achieved by education and participation of the patient to the therapeutic process.

Keywords: Type 2 Diabetes Mellitus, Diabetic Regulation, Patient Education, HbA1c

Üniversite Kliniğimizde İzlenen Tip 2 Diyabetik Hastaların Analizi

ÖZET

Amaç: Bu çalışmanın amacı kliniğimizde izlenen tip 2 diyabetik hastalarda hastalığın farkında olma, tedaviye uyum, hedef Hb A1c düzeyini bilme gibi kan şekeri regülasyonunu etkileyebilecek faktörleri belirlemektir.

Gereç ve Yöntem: Kliniğimizde izlenen tip 2 diyabetik hastalar çalışmaya alındı. Hasta verileri hastane veri tabanı ve dosyalardan elde edildi. Antropometrik ölçümler, kan basıncı, fizik muayene bulguları ve laboratuvar sonuçları kaydedildi. HbA1c seviyesine göre (%8'in altı ve üstü) hastalar iyi kontrollü ve kötü kontrollü diyabetikler olarak 2 gruba ayrıldı.

Bulgular: Toplamda 150 hasta (72'si erkek ve 78'i bayan) çalışmaya alındı. Bel çevresi, beden kitle indeksi, diyabet süresi, LDL- kolesterol, total kolesterol, trigliserid ve serum kreatinini iyi kontrollü diyabetiklerde kötü kontrollü olanlara kıyasla anlamlı derecede düşüktü (hepsi için $p<0.05$). Kentsel alanda yaşan hastalarda iyi kontrol oranı kırsalda yaşayanlardan belirgin olarak daha fazlaydı ($p=0.01$). İlaçlarını tanıyanlarda, kan şekerini evde kendi ölçenlerde, hedef HbA1c düzeyinin farkında olanlarda ve diyabetik nefropati, nöropati ve diyabetik ayak bulunmayanlarda diyabetik regülasyon anlamlı derecede daha iyiydi (hepsi için $p<0.05$).

Sonuç: Bu çalışma daha iyi diyabetik kontrol için, en önemli faktörlerin kendi kendine ölçümlerle kan şekerini takip etmek, tedavi hedef değerlerinin farkında olmak ve kullandığı ilaçları bilmek olduğunu göstermiştir. Bu faktörlerin hepsine iyi bir hasta eğitimi ve hastaların tedavi sürecine katılımları ile elde edilebileceğini düşünmekteyiz.

Anahtar Kelimeler: Tip 2 Diyabet, Diyabetik Regülasyon, Hasta Eğitimi, HbA1c

INTRODUCTION

Type 2 diabetes (T2DM) is a persistent metabolic disease characterized by various disorders in glucose metabolism (1). In the world, the number of patients with T2DM increased from 153 million in 1980 to 347 million in 2008 and is expected to rise to 439 million in 2030 (2, 3). However, it is expected that such great number of diabetics will be reached more recently. In TURDEP-I study in Turkey, the prevalence of type 2 diabetes was reported as 7.2% and the frequency of impaired glucose tolerance (IGT) as 6.7% (4). In following studies, the proportion of T2DM in the population was reported as 13.7% (5). Diabetes and its associated clinical problems put billions of American dollars on health care systems (6). Health expenses due to macrovascular and microvascular complications of diabetes and diabetes constitutes a significant part of the share allocated to total health resources. Strict blood glucose regulation and prevention of complications of diabetes with a multidisciplinary approach in diabetic patients play an important role in reducing disease costs. Multidisciplinary approach reduces mortality and morbidity rates. Having both low socioeconomic status and family history for T2DM, contributes to the increased risk of T2DM (7, 8).

A majority of diabetic patients have a low awareness of diabetes, and the proportion of type 2 diabetics who are unaware of their illness is as high as 45% (5). The World Health Organization (WHO), in an effort to prevent and control diabetes with a program launched in 2004 by the International Diabetes Federation (IDF), has sought to raise global awareness of diabetes (9).

The aim of this study, which we have carried out in our internal medicine clinic, is to analyze the T2DM patients followed up in our clinic. Besides, it is aimed to determine the effect of factors such as awareness of the disease, adaptation to diabetes treatment, self-monitoring, HbA1c target level, regular follow-up to glucose regulation. The presence of comorbidities such as demographic and socioeconomic characteristics of T2DM patients, compliance with lifestyle changes such as diet, exercise, hypertension, and coronary artery disease have been investigated. Finally, it is aimed to provide data on what needs to be addressed in order to raise the control ratios of T2DM, an important public health problem.

MATERIAL AND METHODS

Patients 18 years or older who applied for T2DM between 02.05.2017-01.09.2017 were included in this study. After receiving approval from the authority of our institution, the patient's data were obtained and saved from the database, the computerized database and patient files. Total cholesterol, triglyceride, HDL, LDL, HbA1c, hemogram, urea, creatinine, sodium, potassium, ALT, AST and uric acid parameters were routinely studied in the patients. Patients' blood pressure, weight, height, waist circumference, and BMI were recorded. Patients were divided into 2 groups according to HbA1c levels. Those under HbA1c 8 were considered reasonable diabetic control, those above 8 were considered unreasonable diabetic control.

Statistical analysis: The collected data were recorded on a computer program on SPSS 15 (SPSS 15.0 for Windows, IBM, Chicago, IL, USA). Kolmogorov-Smirnov test was used to assess whether the variables fit the normal distribution. The t test was used to analyze the homogeneous distribution of the variables and the values were expressed as mean ± standard deviation. Mann-Whitney U test was used for the analysis of the variables with no homogeneous distribution and the values were expressed as median (minimum-maximum). Pearson chi-square test was used to compare categorical data. The level of statistical significance was accepted as $p < 0.05$.

RESULTS

We enrolled 150 patients, 72 of which were male and 78 were female. The mean age of patients with HbA1c below 8 was 59.71 ± 11.9 years, the mean age of patients with HbA1c above 8 was 59,34 ± 10 years. Table 1 shows the general characteristics and laboratory values of the study population.

Diabetic patients with reasonable control were 30 male and 35 female (46% male, 54% female). Diabetic patients with unreasonable control were consisted of 42 male and 43 female (49% male, 51% female). When gender and diabetes control rate were compared, there was no statistically significant difference between diabetic and non-diabetic group ($p = 0.743$). There was no statistically significant difference in diabetic control rate compared with age ($p = 0.838$), systolic blood pressure (SBP) ($p = 0.696$) and diastolic blood pressure (DBP) ($p = 0.084$).

There was statistically significant difference in waist circumference, BMI and DM duration compared to diabetes control ($p = 0.009$, $p = 0.025$, $p = 0.010$, respectively). As expected, there was a statistically significant difference between the groups when fasting blood glucose and HbA1c were compared ($p<0.001$). Furthermore, LDL cholesterol, total cholesterol, triglyceride and creatinine diabetic patients with reasonable control were significantly lower ($p<0.001$, $p=0.009$, $p=0.006$, $p=0.029$) and vitamin D levels were significantly lower in diabetics with unreasonable control compares to subjects with reasonable control ($p=0.01$). However, urea ($p=0.392$), HDL ($p=0.452$), uric acid ($p=0.163$) and sodium ($p=0.856$) were not statistically different in study groups.

Table 1. General characteristics and laboratory parameters of the study group

		Reasonable Control	Unreasonable control	p
Gender (M/F)	Male (n)	30	42	0.743
	Female (n)	35	43	
		Mean ± standard deviation		
Age (year)		59±11,9	59,3±10	0.838
FBG (mg/dL)		131.97±33,5	209±67,1	**<0.001**
Urea (mg/dl)		36,6±5,9	43,2±322,2	0.392
LDL Cholesterol (mg/dl)		105.6±36.8	128.7±32.2	**<0.001**
Total Cholesterol (mg/dl)		180,89±47,7	201,81±49,7	**0.01**
HDL Cholesterol (mg/dl)		43.8±10	45.03±9.8	0.452
Üric Acid(mg/dl)		5,34±1,75	5±1,19	0.163
		Median (min-max)		
SBP (mmHg)		130 (100-170)	120 (100-180)	0.696
DBP (mmHg)		80(60-100)	80(60-120)	0.084
BMI (kg/m^2)		28.69(20.57-46.87)	30.48(22.58-52.20)	**0.025**
Triglyceride (mg/dl)		154(69-850)	182(65-1050)	**0.006**
Creatinine (mg/dl)		0.79 (0.5-1.96)	0.83 (0.6-1,55)	**0.029**
Na (mmol/dl)		139 (129-145)	138 (132-145)	0.856
Duration of diabetes (year)		4(1-20)	8 (1-30)	**0.010**
Vitamin D (ng/ml)		13,9(3,4-36)	9,4(4,9-34)	**0.010**
Waist circumference (cm)		100 (75-141)	105 (80-141)	**0.009**

FBG: fasting blood glucose, SBP: systolic blood pressure, DBP: diastolic blood pressure, BMI: body mass index, Na: sodium

Diabetic patients with reasonable control were 30 male and 35 female (46% male, 54% female). Diabetic patients with unreasonable control were consisted of 42 male and 43 female (49% male, 51% female). When gender and diabetes control rate were compared, there was no statistically significant difference between diabetic and non-diabetic group (p = 0.743). There was no statistically significant difference in diabetic control rate compared with age (p = 0.838), systolic blood pressure (SBP) (p = 0.696) and diastolic blood pressure (DBP) (p = 0.084). There was statistically significant difference in waist circumference, BMI and DM duration compared to diabetes control (p = 0.009, p = 0.025, p = 0.010, respectively). As expected, there was a statistically significant difference between the groups when fasting blood glucose and HbA1c were compared (p<0.001). Furthermore, LDL cholesterol, total cholesterol, triglyceride and creatinine diabetic patients with reasonable control were significantly lower (p<0.001, p=0.009, p=0.006, p=0.029) and vitamin D levels were significantly lower in diabetics with unreasonable control compares to subjects with reasonable control (p=0.01). However, urea (p=0.392), HDL (p=0.452), uric acid (p=0.163) and sodium (p=0.856) were not statistically different in study groups.

Of the patients who were not employed, 139 were married (60 in reasonable control, 79 in unreasonable control), 11 were single (5 in reasonable control and 6 in unreasonable control). Marital status was not significantly different in study groups (p = 0.883). 54 of diabetic patients were from rural areas (16 reasonable control, 38 unreasonable control), 96 from urban areas (49 reasonable control, 47 unreasonable control). There was a statistically significant difference between the groups according to living environment (p=0.01). No statistically significant difference was found when patients' diets and exercises were compared in study groups (p=0.315, p=0.546). There was a statistically significant difference between study groups according to patients who knew the name of the drugs compared to who did not know and patients who measured blood glucose at home compared to who do not (p=0.007, p<0.001). No statistically significant difference was found between study groups according to knowledge of definition of diabetes and awareness of blood glucose target levels. (p=0.435, p=0.504). However, there was a statistically significant difference in HbA1c between study groups (p=0.02). There were statistically significant differences between study groups according to diabetic complications; neuropathy, nephropathy and diabetic foot (p=0.01, p=0.039, p=0.044). However, no statistically significant difference was found when compared to retinopathy (p = 0.090)

DISCUSSION

One of the most important issues in the treatment of diabetes is the education of the patient. Patient education is also defined as "the exchange of information, tools and practices that meets the needs of the patient"(10). The most important factors that have a positive effect on reasonable diabetic control in our study are low BMI, waist circumference, LDL, triglyceride and total cholesterol levels (Lower in reasonable diabetic control) and living in urban area. It was also found that patient education could measure blood glucose

at home, know the target level of HbA1c, and know the name of the drugs used.

The average age of patients with type 2 diabetes is around 65 years (9). Similarly, the mean age of the reasonable and unreasonable diabetic control with type 2 diabetes mellitus in our study was 59.

Contrary to previous studies, new studies have reported that there is no difference in the frequency of diabetes among rural and urban inhabitants, suggesting that the sedentary lifestyle is increasingly widespread in rural areas (5). In our study, people living in urban areas, diabetes mellitus was more reasonable ($p = 0.011$). This is thought to be due to the fact that patients living in urban areas are aware of the fact that diabetes is a serious disease with an increase in the level of education and that it is easier to go to the healthcare service and to go to the controls regularly.

Almost half of all diabetics are not aware of their illness and at serious risk of developing diabetes complications. As such, when diabetes is diagnosed, it appears that chronic complications of diabetes have already developed in many patients (11, 12). In our study, reasonable diabetic control was found to be worse in patients with neuropathy, nephropathy and diabetic foot, as expected. In other words, in the reasonable diabetic control group, neuropathy, nephropathy and diabetic foot were significantly lower than those in unreasonable diabetic control group.

There was no statistically significant difference in between study groups according to the patients' diet and exercise. We think that the subjects in our study are often older, that the diet and exercise is not adequately explained, and that the diet and exercise do not have enough information about the place of the treatment. Patients' Total Cholesterol, Triglyceride and LDL levels were lower in patients with reasonable diabetic control group as expected, and the difference was also statistically significant. There was no dietary difference between the groups but there was a difference between lipid levels, and this difference can be explained by the regular use of lipid-lowering drugs by individuals in both groups.

In the present study, there was a significant difference between the reasonable and unreasonable diabetic control groups in terms of BMI and waist circumference. It is not surprising that BMI in reasonable diabetic control group is lower than in unreasonable diabetic control group, as it is known that BMI> 25 is a risk factor for diabetes mellitus.

In our study, 139 of the patients were married and 11 were single. There was no difference in marital status among the groups. This can be explained by the fact that unmarried diabetics did not change their lifestyle after marriage. However, low number of singles in present study make our result difficult to interpret.

There was a significant difference between the study groups in terms of knowing the name of the drugs and measuring blood glucose at home. Patients are encouraged to make their own blood glucose measurements at home (13). When diabetes treatment is modified according to blood glucose measurement results at home, the control rates can be improved (13). In one study, it was shown that in patients with self-administered diabetes management training, the improvement in HbA1c levels was 3 times higher than that of untrained diabetic patients (14). Blood glucose measurements at home are useful for reaching glycemic targets for diabetics who use both insulin, OAD, and dieting (1). However, there was no consensus on the measurement frequency and timing (1).

When we compared the definition of diabetes and the knowledge of blood glucose target levels in our study groups, no difference was found between them. However, there was a significant difference between the groups in terms of knowing the target level of HbA1c. Since HbA1c is a less known parameter than diabetes patients with blood glucose, it can be assumed that diabetic education of patients with HbA1c target level is better.

The striking result of this single centered retrospective study is that the most important factors to achieve reasonable diabetic control in T2DM patients are the ability to gain from patient education, such as measuring blood glucose at home, knowing the HbA1c target level, and knowing the names of medications they use in treatment. In addition, increased BMI and waist circumference seem to distort glucose metabolism. It is essential for physicians to talk about patients, their disease and treatment in detail, to have understanding and determination to understand and implement the recommendations made by the patient

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