Glycemic Control of Turkish Adult Diabetic Patients

Türkiye'de Tedavi Altındaki Diyabet Hastalarında Glisemik Kontrol

Aytekin Oğuz, *Olcay Gedik, **Hüsrev Hatemi, ***Temel Yılmaz, ****Şazi İmamoğlu, *****Nuri Kamel, ******Candeğer Yılmaz

Göztepe Training and Research Hospital, Second Internal Medicine Division, İstanbul, Turkey
*Hacettepe University, Faculty of Medicine, Department of Endocrinology and Metabolism, Ankara, Turkey
**Istanbul University, Cerrahpasa Faculty of Medicine, Department of Endocrinology and Metabolism, İstanbul, Turkey
***Istanbul University, Faculty of Medicine, Department of Endocrinology and Metabolism, İstanbul, Turkey
****Uludağ University, Faculty of Medicine, Department of Endocrinology and Metabolism, Bursa, Turkey
*****Ankara University, Faculty of Medicine, Department of Endocrinology and Metabolism, Ankara, Turkey
******Ege University, Faculty of Medicine, Department of Endocrinology and Metabolism, İzmir, Turkey

Abstract

Objective: We conducted a cross-sectional observational study to determine the level of glycemic control and other characteristics in adult Turkish patients with diabetes mellitus, who were already receiving treatment.

Materials and Methods: A total of 2358 adult diabetic patients that had been on treatment for at least 3 months and followed in 44 different centers spread throughout Turkey were recruited in the study. Glycemic control was determined by glycosylated hemoglobin (HbA1c) levels using the "A1cNow®" test kit (Metrika Inc. USA) to obtain standard measurements in all centers.

Results: The majority of patients had type 2 diabetes (93.9%). The mean age was 55.7±12.1 years. Patients had been diagnosed with diabetes for 9.1±7.2 years, and they were on treatment for 6.9±6.3 years. In total, 69% of the patients had HbA1c ≥7%, and the mean HbA1c level was 8.0±2.0%. There was no significant difference between male and female patients regarding glycemic control. Of all the patients, 42.7% were obese and 39.7% were overweight. Dyslipidemia and hypertension were present in 76.9% and 88.3% of the patients, respectively.

Conclusions: Diabetes control is insufficient in Turkish patients, and improvements in the current diabetes care standards are needed. *Turk Jem 2008; 12: 50-4*

Key words: Diabetes mellitus, glycemic control, treatment, HbA1c

Özet

Amaç: Türkiye'de tedavi altındaki erişkin diyabetlilerde glisemik kontrol düzeyinin saptanması.

Gereç ve Yöntemler: Kesitsel çalışmaya ülke genelinde 44 merkezden, en azından son 3 aydır tedavi almakta olan diabetes mellituslu 2358 erişkin hasta alındı. Glisemik kontrol tüm merkezlerde standart olarak "A1cNow" (Metrika inc. USA) kitleri kullanılarak belirlenen serum HbA1c düzeylerine gore tanımlandı.

Bulgular: Hastaların büyük çoğunluğu (%93.9) tip 2 diyabetli idi. Ortalama yaş 55.7±12.1 yıl idi. Tanıdan itibaren geçen ortalama süre 9.1±7.2 yıl, tedavi altında oldukları süre 6.9±6.3 yıl idi. Hastaların %64'ünün HbA1c'si %7'nin üzerinde, genel olarak HbA1c düzeyi ortalaması %8±2.0 idi. Kadın ve erkek hastaların glisemik kontrolleri arasında fark yoktu. Hastaların %42.7'si obez, %39.7'si fazla kilolu idi. Dislipidemi ve hipertansiyon sıklıkları sırasıyla %76.9 ve %88.3 idi.

Sonuç: Hastalarımızda diyabet kontrolü yetersizdir. Mevcut diyabet bakım standartlarının düzeltilmesi gereklidir. *Turk Jem 2008; 12: 50-4*

Anahtar kelimeler: Diabetes mellitus, glisemik control, tedavi, HbA1c

Introduction

Diabetes mellitus is a life-long disease with an estimated prevalence of 2.8% worldwide in 2000, and an estimated prevalence of 4.4% by the year 2030 (1). In Turkey, a country-wide epidemiological study conducted during 1997-1998 on 24,788 adults revealed a 7.2% prevalence of diabetes (2).

Diabetes is a progressive disease that leads to microvascular and macrovascular complications. Studies have shown that tight glycemic control can slow down or reduce microvascular complications both in type 1 and type 2 diabetic patients (3-7). Similarly, according to results from the UK prospective diabetes study, each 1% reduction in glycosylated hemoglobin (HbA1c)

Address for Correspondence: Aytekin Oğuz, MD, Göztepe Training and Research Hospital, Second Internal Medicine Division, İstanbul, Turkey
Tel.: +90 532 790 30 81 E-mail: aytekinoguz@hotmail.com **Recevied:** 28.02.2008 **Accepted:** 28.06.2008
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was associated with a 14% reduction in myocardial infarction, 21% reduction in deaths related to diabetes, and 37% reduction in microvascular complications (8).

There have been no large-scale studies in Turkey to determine the treatment trends of diabetes and the efficacy of treatment. In this descriptive countrywide cross-sectional study, we primarily aimed to determine the level of glycemic control in adult diabetic patients, who were receiving treatment in Turkey. The HbA1c level was used as the main indicator of glycemic control. The secondary objective of this study was to describe the demographical and clinical characteristics of these diabetic patients.

Materials and Methods

Patient population

As a representative sample population in Turkey, 2358 adult diabetic patients (1403 women, 924 men) currently receiving treatment were included in the study. Inclusion criteria were adult age (≥18 years old); established diagnosis of diabetes; being on diabetes treatment of life style modification (i.e. diet and exercise), oral hypoglycemic agents (OHA) or insulin for at least three months; and attending one of the 44 centers that participated in the study. The study centers were selected to represent the geographical and institutional distribution of diabetic centers in Turkey. Ethics committee approval was obtained from the coordinator center and informed consent was obtained from all patients. The last version of the Declaration of Helsinki (1975) and Good Clinical Practices were followed throughout the study.

Patients who were younger than 30 years of age at diagnosis, and had continuous or almost continuous insulin use since diagnosis were classified as having type 1 diabetes. Patients that did not meet these criteria were classified as having type 2 diabetes.

Study procedures

Patients were to complete a detailed questionnaire regarding patient history of diabetes, complications due to diabetes, concomitant diseases and medicines, current treatments, and time and result of laboratory tests last performed. All patients had a physical examination. Blood pressure was measured from both arms after resting for 10 minutes in a seated position. A second measurement was taken 3 minutes later from the arm that had the higher blood pressure, and mean systolic and diastolic blood pressures were calculated. Waist circumference was measured horizontally midway between the lowest rib and the iliac crest in the standing position with slight expiration. Body mass index (BMI) was calculated using the Quetelet index (weight/height^2 = kg/m^2) (9). The primary evaluation criterion was the level of HbA1c as measured by the "A1cNow®" test kit (Metrika Inc. USA). This kit was used in order to have uniform measurements across all the centers. Good glycemic control was defined as HbA1c<7% (10).

Statistical analysis

Descriptive statistics were performed for all applicable data. Differences in glycemic control according to different treatment regimens or according to different physician specialties were analyzed by ANOVA. P<0.05 was considered significant. Data are presented as mean ± standard deviation, as appropriate.

Results

Sociodemographic profile

A total of 2358 patients participated in the study. The patient profile is summarized in Table 1. Patients were 55.7±12.1 (18-97) years old and 60.3% of them were female. The majority of patients had type 2 diabetes (93.9%). The mean duration since diagnosis of diabetes was 9.1±7.2 years. Patients had been on treatment for 6.9±6.3 years. A family history of diabetes (first degree relatives) was present in 57.3% of patients. A total of 66.2% of the patients reported that they had received some form of diabetes education.

Glycemic control

A total of 524 patients (22.2%) were on insulin treatment with or without OHA. Table 2 summarizes the current diabetic treatments and prevalence of use for the study population. The most frequently used forms of insulin were premixed insulin (12.9%) and Neutral Protamine Hagedorn (NPH) (12.2%). The most frequently used OHAs were sulphonylureas (38.3%) and metformin (35.9%).

In total, good glycemic control, defined as HbA1c<7%, was present in only 36.0% of the diabetic patients (Figure 1). The remaining 64.0% of the patients had poor glycemic control (HbA1c levels of 7-8%, 8 - 10% and>10% in 22.9%, 26.2% and 14.9% of the patients, respectively). The ratio of patients with good glycemic control versus poor control was similar in males

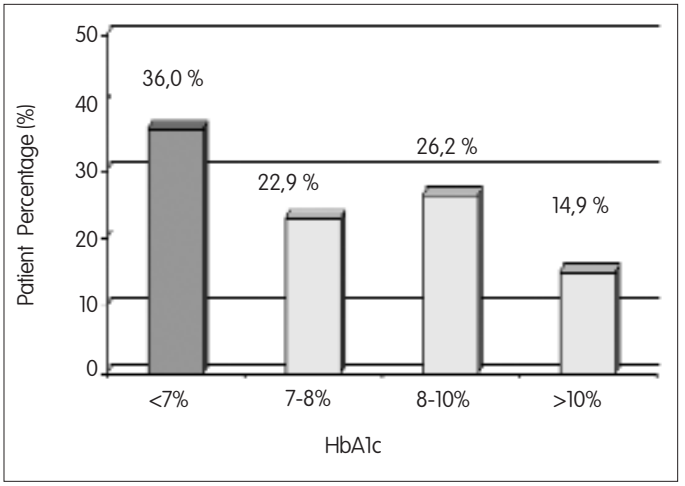

Figure 1. Distribution of patients under good and poor glycemic control (HbA1c < 7% is defined as good glycemic control

Table 1. Sociodemographic characteristics of patients enrolled in the study

Characteristics		
Age (years; mean±SD)		55.7±12.1
Gender [n (%)]	Female	1403 (60.3)
	Male	924 (39.7)
Education level, [n (%)]	Illiterate	428 (19.5)
	Literate	188 (8.6)
	Elementary school	843 (38.4)
	Middle school	483 (22.0)
	High school and above	254 (11.6)
Body mass index (kg/m^2; mean±SD)		28.9±5.0
Diabetes [n (%)]	Type 1	136 (6.1)
	Type 2	2095 (93.9)
Duration of diabetes (years; mean±SD)		9.1±7.2
Duration of treatment (years; mean±SD)		6.9±6.3
Family history of diabetes [n (%)]	1st degree relatives	1266 (57.3)
	2nd degree relatives	612 (35.0)
Diabetes education, [n (%)]		1447 (66.2)
Smoking, [n (%)]	Never smoked	1506 (65.7)
	Smoked in the past	358 (15.6)
	Currently smoking	428 (18.7)
Alcohol consumption, [n (%)]		89 (4.0)

SD: Standard deviation

and females. The percent of patients under glycemic control was lower in insulin users (26.4%) than in non-insulin users.

Only 45% of the patients had their HbA1c measured at least once within the past year. The mean HbA1c level measured in tests performed within the last year was 8.1±2.2%, which was similar to the mean HbA1c level of 8.0±2.0% detected during this study. The mean HbA1c level in insulin users was 8.5±2.0%, which is significantly higher than the 7.9±1.9% measured in OHA users (P<0.001) (Table 3).

Patients' HbA1c measurements showed a significant difference (P<0.001) according to the specialist treating their condition. The lowest HbA1c levels were found in patients treated by family medicine specialists (Table 4). Moreover, there was a significant difference (P<0.001) in the insulin dosages prescribed by physicians from different specialties, such that endocrinologists were found to prescribe the highest dose of insulin (Table 4).

Other laboratory findings

All laboratory findings obtained from patient records are summarized in Table 5.

Table 2. Current treatment of diabetes in study patients (n = 2358)

Treatment		%
Life style modifications	Diet	54.6
	Exercise	37.3
Oral antidiabetic drugs	Sulphonylurea	38.3
	Metformin	35.9
	Acarbose	11.2
	Glitazone	6.8
	Glinide	4.7
Insulin	Premixed insulin	12.9
	NPH	12.2
	Regular insulin	5.9
	Rapid acting analog	4.3
	Premixed analog	4.2
	Long acting analog	3.8

NPH: Neutral Protamine Hagedorn

Mean fasting blood glucose (FBG) were 185.9±75.0 mg/dL, and mean postprandial blood glucose levels were 230.7±99.7 mg/dL. Mean values for lipid and cholesterol subsets were as follows: total cholesterol, 221.0±112.4 mg/dL; triglycerides, 183.6±112.0 mg/dL; HDL-cholesterol, 50.0±9.9 mg/dL; and LDL-cholesterol, 120.9±43.0 mg/dL. Of the patients in this study, 50.6% had total cholesterol>200 mg/dL, 55.3% had triglycerides>150 mg/dL, and 46.5% had low HDL-cholesterol (defined as<40 mg/dL for men, <50 mg/dL for women).

Microalbuminuria tests were performed in a smaller group of patients, and the mean level of microalbuminuria was found to be 53.2±122.2 mg/day (n=412). Mean serum creatinine and BUN levels were 2.6±11.3 mg/dL and 39.2±30.1 mg/dL, respectively.

Among the laboratory tests recorded, FBG (1313 patients) and total cholesterol (956 patients) were the two tests done for most patients within the last year.

Obesity and concomitant diseases

Only 17.6% of the patients had BMI lower than 25 kg/m^2. Overweight (BMI 25-29 kg/m^2) and obesity (BMI≥30 kg/m^2) were seen in 39.7% and 42.7% of the patients, respectively. According to the waist circumference measurements, 75% of the women and 32.7% of the men displayed abdominal obesity (defined as ≥88 cm for women, and ≥102 cm for men). Among concomitant diseases, dyslipidemia (76.9%) and hypertension (88.3%) were the most common. The most frequently used drugs for lipid lowering were statins (48.9%), while the most frequently used antihypertensive agents were ACE inhibitors (52.2%). Other concomitant diseases included congestive heart failure (8.8%), chronic obstructive pulmonary disease (4.4%), chronic liver disease (1.4%), and cancer (1.2%).

Microvascular and ocular complications were highly common among diabetic patients. A total of 49.7% of patients reported paresthesia, 26.6% reported retinopathy, 12.1% reported cataract, and 11.1% reported laser surgery in the eye due to diabetes related complications. Albuminuria (16.2%), urinary incontinence (9.6%), orthostatic hypotension (8.1%), angina pectoris (7.0%), and diabetic foot lesions (5.8%) were other frequently reported complications.

Table 3. HbA1c level (%) as mean±standard deviation according to insulin treatment, and patient gender

		n	HbA1c (%)	P value
	All patients	2197	8.0±2.0	
Insulin treatment	Insulin users	484	8.5±2.0	<0.001
	OHA users	1703	7.9±1.9	
Gender	Male	842	7.9±1.9	NS
	Female	1315	8.0±2.0	

NS: Not significant; OHA: Oral hypoglycemic agent

Table 4. Insulin treatment dosages and HbA1c levels according to physicians' specialty

		Insulin dosage			HbA1c level	
			P			P
Physicians' specialty	n	Dosage [U]	value	n	HbA1c level	value
Endocrinology	170	50.9±30.0	0.001	320	7.8±1.9	0.001
Internal medicine	330	43.1±19.5		1164	8.2±2.0	
Family medicine	29	40.8±20.4		89	7.3±1.5	
General practitioner	74	39.0±12.3		410	7.9±1.7	
All physicians	603	44.7±22.7		1983	8.0±1.9	

Table 5. The results of laboratory tests previously performed

Laboratory test	n	Mean±standard deviation
FBG (mg/dL)	2074	185.9±75.0
2-h PPBS (mg/dL)	1058	230.7±99.7
Total Cholesterol (mg/dL)	1636	221.0±112.4
HDL-cholesterol (mg/dL)	1208	50.0±19.9
LDL-cholesterol (mg/dL)	1201	120.9±43.0
Triglycerides (mg/dL)	1558	183.6±112.0
BUN (mg/dL)	1497	39.2±30.1
Serum Creatinine (mg/dL)	1431	2.6±11.3
Urine Protein (mg/day)	199	83.4±140.9
Microalbuminuria test (mg/day)	412	53.2±122.2
ALT (U/L)	1339	28.4±38.1
GGT (U/L)	919	30.5±38.1

FBG: fasting blood glucose; 2-h PPBS: 2 hours postprandial blood glucose; HDL: high density lipoprotein; LDL: low density lipoprotein; BUN: blood urea nitrogen; ALT: alanine transaminase; GGT: g-glutamyl transferase.

Discussion

Our results indicate that, in general, Turkish adult diabetics are under poor glycemic control. Specifically, 64% of the patients in this study had HbA1c ≥ 7.0%. Similar studies conducted in other countries over the last decade also found poor glycemic control in a substantial portion of patients. A retrospective observational study in Finland found that mean HbA1c levels were 8.5±1.9% in type 2 diabetic patients, with only 25% of patients having HbA1c below 7.3% (11). A US study demonstrated that of all the sampled patients with type 2 diabetes, 37.1% had HbA1c>8%, including 51.5% of insulin-treated patients, 42.4% of those taking oral agents, and 15.0% of those treated with diet alone (12). US National Health and Nutrition Examination Surveys from 1988 and 2000 indicated that rates of good glycemic control (HbA1c<7%) had declined from 44.5% to 35.8% among patients with diagnosed type 2 diabetes (13). These and other results from similar studies demonstrate a trend of poor glycemic control in the world.

In a study investigating the factors contributing to poor glycemic control, age, motivation, understanding of the disease, and compliance with diet and medications were found to correlate statistically with diabetes control (14). At least some of these factors could be modified by patient education and intensive disease management. About two thirds of the patients in our study had received diabetic education, though the quality of this education was not assessed. In a study investigating the effectiveness of diabetic education, those patients with low literacy receiving intensive disease management from a multidisciplinary team were more likely to lower their HbA1c levels compared to low literacy patients receiving regular care (15). However, such intensive management programs are difficult to implement in most places. In contrast, a meta-analysis investigating the benefits of diabetic education from independent studies found that overall HbA1c levels were only 0.320% lower in the educated group compared to others (16).

Another factor contributing to poor glycemic control may be the sub-optimal drug treatment regimens. A Turkish study conducted in 11 cities with 305 physicians and 2226 patients revealed that most diabetic cases in Turkey were not treated according to current guidelines. Furthermore, most patients were treated with oral anti-diabetic monotherapy regardless of the duration of diabetes, metabolic control, complications, and cardiovascular risk factor status (17). Results from the UK prospective diabetes study indicate that monotherapy with diet, oral anti-diabetic agents, or insulin is not sufficient to keep the HbA1c level below 7%, and that combination therapies are required for type 2 patients (18). Recent studies suggest that the addition of basal insulin to oral anti-diabetic agents early on during the treatment might be beneficial for achieving tight glycemic control (19-22).

In our study, the highest mean HbA1c levels were found in patients seen by internal medicine specialists. This is probably due to the fact that patients with other complications such as nephropathy, cardiovascular disease and infection are referred to internal medicine specialists. Therefore, these patients may be at a more advanced disease stage than patients seen by other types of medical professionals.

Obesity is an important problem in diabetes leading to insulin resistance and further complications. Approximately 83% of the patients in this study were obese or overweight. Abdominal obesity was seen in about three quarters of all diabetic women and in about one third of all diabetic men. These observations highlight the fact that risk factors other than glycemic control can also play important role in the development of macrovascular and microvascular complications of diabetes.

Conclusions

In conclusion, poor glycemic control in the majority of adult diabetic patients, who are already poorly managed in terms of other cardiometabolic risk factors, indicates that urgent measures are needed nationwide in Turkey to combat the growing problem of diabetes.

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Appendix

Study Group

Acar M, Agdas S, Akalpoglu S, Algun E, Altuntas Y, Amca S, Ates F, Aydin A, Aydin N, Aykanat I, Bahceci M, Balkanci H, Bozoglu CA, Cetinarslan B, Demir A, Dereli D, Dogan H, Dorsan F, Erdemir F, Gultepe O,Hekimsoy Z, Ilter E, Karaahmetoglu S, Karakurt F, Karci C, Kaya D, Kultur M, Oktem IK, Ozata M, Ozcan Z, Ozmen B, Ozokcu M, Sagun G, Sahin N, Sargin H, Seker M, Sengul A, Senkal O, Sezer A, Sorgun O, Soysal S, Tas A, Tugrul A, Uzman H, Yavuz H, Yazici H, Yildiz F, Yildiz G, Yildizbas Z, Yigit D, Yonem A, Yurtsever E.

Study Centers

Adana Numune Hospital, Akdeniz University Medical School, Turkish Diabetes Association Mersin Division, Antakya State Hospital, Kahramanmaras State Hospital, Erzurum State Hospital, Van 100th Year University Medical School, Malatya State Hospital, Elazıg Fırat University Medical School, Ege University Medical School, Buyukcigli Primary Health Care Clinics Diabetes Center, Celal Bayar University Medical School, Adnan Menderes University Medical School, Turkish Diabetes Association Denizli Division, Afyon State Hospital, Dalaman 2nd Primary Health Care Clinics Diabetes Center, Kutahya State Hospital, Sanlıurfa State Hospital, Dicle University Medical School, American Hospital, Mardin State Hospital, Adıyaman State Hospital, Hacettepe University Medical School, Ankara Numune Hospital, Konya Numune Hospital, Kayseri State Hospital, Sivas State Hospital, Eskişehir State Hospital Diabetes Clinics, Aksaray State Hospital, Turkish Diabetes Association Corum Division, Samsun State Hospital, Trabzon State Hospital, Ordu State Hospital, Tokat State Hospital, Zonguldak State Hospital, Turkish Diabetes and Obesity Foundation Harbiye Division, Istanbul University Cerrahpasa Medical School, Goztepe State Hospital, Istanbul University Istanbul Medical School, Uludag University Medical School, Kocaeli University Medical School, Balıkesir State Hospital, Sakarya State Hospital, Tekirdag State Hospital.

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