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Research Article

Clinical Characteristics of Diabetics in a Single Tertiary Center

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Abstract

Purpose: This study aims to investigate the metabolic parameters and complications of patients with diabetes mellitus followed in a tertiary endocrine and diabetes center.

Method: This prospective randomized study was conducted with the first 350 diabetes mellitus patients admitted to a tertiary endocrine center between 1 July and 31 September 2021. The patients included in the study were investigated in terms of gender, age, duration of diabetes, diabetes type, HbA1c level, lipid panel, and microvascular complications.

Results: A total of 350 (Type 1/Type 2: 78 (46,1% female)/272 (69,4% female), 77% of the patients had Type 2 diabetes) patients were included in the study. The mean age was 55 years in type 2 diabetes patients and 32 years in type 1 diabetes patients.

The mean duration of diabetes in type 1 diabetes and type 2 diabetes was 9,2 and 10,3 years, respectively. Mean HbA1c in type 1 and type 2 was 11,3 ± 3.2%, 10,9 ± 2,9% respectively. While there was no difference in HDL and LDL levels, mean triglyceride levels were higher in Type 2 DM (180,4 vs. 137,2 $p < 0,05$). Retinopathy was observed more frequently in Type 2 DM (58% vs 33,3% $p < 0,05$). Proteinuria was observed in 47,4% in Type 1 DM and 42,6% in Type 2 DM. Hypertension was found to be 48,8% in Type 2 DM and 20,5% in Type 1 DM ($p < 0,05$). The percentage of patients with HbA1c levels < 7 was 21,7% in Type 1 DM and 11% in Type 2 DM. The percentage of patients with Triple lipid control was 21,7% in Type 1 DM and 9,1% in Type 2 DM. The percentage of patients with metabolic control was 6,4% in Type 1 DM and 4,7% in Type 2 DM.

Conclusion: The rate of patients who cannot reach metabolic control targets in diabetic patients is still very high. About half of the patients have chronic complications. New strategies are needed to achieve metabolic controls and reduce complications.

Keywords: *Type 1 Diabetes; Type 2 Diabetes; HbA1c; Metabolic Control; Complications*

Abbreviation

TG: Triglyceride

Introduction

Diabetes Mellitus is the most prevalent chronic disease worldwide, affecting approximately 500 million adults [1]. Diabetes mellitus is a severe disease with chronic complications, and these complications cause significant financial losses and loss of workforce [2].

Glycemic control is essential in diabetic patients to reduce cardiovascular complications [3].

Diabetic nephropathy is a prevalent microvascular complication in the diabetic population, affecting a quarter of people with type 2 diabetes and is responsible for at least a third of end-stage renal disease. Diabetic retinopathy is the most common cause of blindness in the world. It affects approximately 25% of diabetic individuals. Diabetic neuropathy is present in almost half of diabetic patients, including asymptomatic patients [4,5].

Although there are many antidiabetic drugs, we still cannot reach the desired targets. Therefore, new treatments should be developed with different perspectives to reduce diabetes-related morbidity and mortality [6].

Aim of the Study

This study aims to investigate the metabolic parameters and complications of patients with diabetes mellitus followed in a tertiary endocrine and diabetes center.

Materials and Methods

Study population

This prospective study included patients diagnosed with Type 1 and Type 2 diabetes mellitus who applied to the Dicle University Faculty of Medicine Endocrinology and Metabolism outpatient clinic between 1 July and 30 September 2021.

Inclusion criteria: (To have been followed in the outpatient clinic for at least one year): > 18 years old, metabolic parameters are checked and screened for complications.

Exclusion criteria: Patients < 18 years old, pregnant, cancer patients, renal replacement therapy, liver failure and psychiatric patients.

Data collection: Between 1 July 2021 and 30 September 2021, 100 - 150 patients per month were randomly selected from the patients who applied to our outpatient clinic.

Tested parameters: Age, gender, diabetes type, diabetes duration, fasting glucose, HbA1c measurements from the electronic files of the patients who were registered with the diagnosis code of 'Type 1 Diabetes Mellitus' or 'Type 2 Diabetes Mellitus' to the Endocrinology and Metabolism Outpatient Clinic of Dicle University Faculty of Medicine. HbA1c level, C-peptide level, lipid profile (triglyceride, total cholesterol, HDL, LDL), creatinine, ALT, spot urine protein/creatinine ratio, antidiabetic drugs used, microvascular complications (nephropathy and retinopathy were evaluated) and comorbidities (presence of hypertension) were examined and recorded.

During the analysis, some concepts were defined as follows:

1. Dyslipidemia: TG was defined as > 150 and/or LDL-C ≥ 100 and/or low HDL-C (male < 40, female < 50 mg/dL).
2. Target was defined as HbA1c < 7%.
3. Retinopathy was defined as abnormal fundus examination.
4. Nephropathy was defined as albuminuria and increased creatinine in patients.
5. Metabolic control: It was defined as HbA1C < 7%, LDL < 100 mg/dL and target HDL value (> 40mg/dL for men, > 50 mg/dL for women).

6. Glycemic control: Defined as HbA1c < 7%.

Statistical analysis

Data analysis was performed using the SPSS 26 (Statistical Package Social Science) statistical program. Categorical variables were expressed as numbers and percentages. Among the numerical variables, those with normal distribution were shown as mean ± standard deviation and those with normal distribution as median (min-max). What evaluated categorical data with the Mann Whitney U test and Kruskal Wallis tests since the chi-square and continuous data did not fit the normal distribution. P < 0.05 was considered statistically significant.

The study was approved by the Local Ethics Committee of Dicle University School of Medicine, Diyarbakır (2021) and conducted in compliance with the Declaration of Helsinki.

Results

A total of 350 patients were included in the study. Male/Female: 161/189; 54% of the patients were female. There was a female predominance in type 2 diabetic patients. While the mean duration of diabetes in Type 1 DM was 9.2 years, it was 10.3 years in Type 2DM. While the mean HbA1c was 11.3% in Type 1 DM, and 10.9% in Type 2DM. While there is no statistical difference between the mean LDL and HDL values between the two diabetes types, Triglyceride level was higher in Type 2 DM (180,4 vs 137,2 p < 0,05). Retinopathy was more common in Type 2 DM (58% vs. 33%). Hypertension was present in 48.8% of Type 2DM patients. While the rate of glycemic control was 8.9% in Type 1 DM, this rate was 11% in Type 2 DM (Table 1).

	Type 1 diabetes	Type 2 diabetes	P value
Total n: 350 M/F: 161/189 Female 54%	78/23%	272/77%	
Female sex	46,1%	69,4%	< 0,05
Age (years)	32 ± 12,8	55,2 ± 12,3	< 0,05
Diabetes duration (years)	9,2 ± 8,2	10,3 ± 7,6	NS
Fasting glucose (mg/dL)	234 ± 82,5	209 ± 84,5	< 0,05
HbA_{1c} (%) (mean) 10,9 (6,1 - 18,3)	11,3 ± 3,2 (6,6 - 18,3)	10,9 ± 2,9 (6,1 - 17,8)	NS
LDL (mg/dL)	109,7 ± 35,6	115 ± 44,1	NS
HDL (mg/dL)	47,5 ± 14,3	42,6 ± 12,2	NS
Triglycerides (mg/dL)	137,2 ± 86,7	180,4 ± 96,3	< 0,05
Retinopathy, n (%)	26 (33,3%)	158 (58%)	< 0,05
Proteinuria, n (%)	37 (47,4%)	116 (42,6%)	NS
HT, n (%)	16 (20,5%)	133 (48,8%)	< 0,05
Glycemic control (HbA1c < 7)	7 (8,9%)	30 (11%)	NS
Triple lipid control* (Trigly., LDL, HDL)	17 (21,7%)	25 (9,1%)	NS
Metabolic kontrol (Glycemic+Triple Lipid)	5 (6,4%)	13 (4,7%)	NS
Statin therapy, n (%)	5 (6,4%)	61 (22,4%)	NS
NS: Not Significant, *Triglycerid < 150 mg/dL, LDL < 100 mg/dL, HDL < 40 mg/dL			

Table 1: *Clinic characteristics of patients.*

Discussion

In this study, we found that the glycemic and metabolic parameters of diabetic patients were worse than the target values. This situation may reflect that the incidence of diabetes-related macro-microvascular complications will increase in the coming years. The period we conducted our study coincides with the Covid-19 pandemic process; the negative effect of the pandemic process on glycemic control and the inclusion of patients with poor metabolic control who were referred to a tertiary diabetes center may explain this poor metabolic profile. Although the possible mechanism of action of SARS-CoV-2 on pancreatic islet cells and the course of diabetes has not yet been clearly proven, it has been observed in many studies that it complicates blood sugar regulation in patients infected with SARS-CoV-2. Deterioration of healthy nutrition and exercise restrictions during lockdown may explain this situation. In addition, the decrease in hospital admissions due to the difficulty of patient follow-up and the risk of transmission of Covid-19 infection in this period may also have caused the poor metabolic profile. Meta-analyses have shown that COVID-19 lockdown significantly increases HbA1c, fasting glucose, and body mass index levels in patients with type 2 diabetes [7-9].

Currently, diabetes emerges as a health problem of increasing importance worldwide due to its increasing frequency and problems caused by the rapid increase in obesity and metabolic syndrome. As a result of changes in lifestyle in all developed and developing countries, the prevalence of Type 2 diabetes is increasing rapidly. When different studies conducted in many countries around the world are compared with previous studies, it has been observed that the frequency of diabetes has increased many times compared to previous studies. In a meta-analysis by Shaw., *et al*. including 133 studies from 91 countries, it is predicted that the incidence of diabetes will increase by 57,2% in developing countries and 25,4% in developed countries from 2011 to 2030 [10]. One of the most comprehensive studies reflecting the prevalence of diabetes in Turkey in recent years is the "Turkey Diabetes Epidemiology Study" (TURDEP- I) conducted in 1997-1998. According to the study results, the frequency of diabetes was determined as 7,2% [11]. In 2010, the same study was carried out again by the people who carried out the previous study, as the TURDEP- II study. When TURDEP- II and TURDEP- I studies were compared, it was observed that the incidence of diabetes increased by 90% and reached 13,7% [12].

When the world and Turkey data are examined, it has been observed that the prevalence of diabetes has increased significantly. Due to this rapidly increasing disease frequency, there has been a significant increase in microvascular and macrovascular complication rates [13].

When the International Diabetes Management Practice Study (IDMPS) results were examined, 41,5% of patients with Type 2 diabetes mellitus were observed to have late complications related to the disease. When examining the frequency of late complications related to diabetes, 50,6% of the patients diagnosed with Type 2 diabetes with complications had retinopathy, 43,5% had neuropathy, 28,8% had microalbuminuria and 23,1% had coronary events. Moreover, myocardial infarction was detected. It was observed that the risk of developing microvascular complications in type 2 diabetes patients increased with the duration of the disease and the severity of hyperglycemia [14].

In our study, we observed that the rates of retinopathy and nephropathy, which we examined from microvascular complications, were higher in patients with type 2 diabetes who were not under glycemic control under the literature.

There are not enough studies on diabetes and its complications in our country. Three hundred fifty patients receiving tertiary treatment from a single health institution were included in our study. The mean HbA1c was 11,3% in Type 1 DM and 10,9% in Type 2 DM. HbA1c level was found below 7% in 10,6% of the patients.

If we examine a study conducted by Sönmez., *et al*. in Turkey. In the analysis that included 4648 patients, the mean duration of diabetes was found to be 10,84 ± 7,53, similar to our study, and the mean HbA1c level was found to be 7,73 ± 1,74, which was lower than the results

of our study. The younger the patients with diabetes, the more diabetic complications, and deaths occur. There is a relationship between the duration of diabetes and complications and mortality [15,16].

We think the difference in the mean HbA1c level is due to the differences in the patients' comorbid status and socio-cultural status. Again, we think that differences in patients' awareness of diabetes and differences in lifestyle may also impact. In the study we conducted in Diyarbakır, we think that the number of patients with glycemic control was low due to the very low rate of diabetes awareness in Diyarbakır, which was the result of the TURDEP- II study [12].

In our study, the HbA1c level was lower than 7% in 10,6% of the patients. In the TURDEP-II study, this rate was 7% or higher in approximately 51,2% of the patients, unlike our study [12]. In the analysis performed by Sonmez., *et al*. the HbA1c level was observed to be above 7% in 59,9% of the cases [12]. Different data were obtained in the analyzes performed at different times in our country. In our country, regional socio-cultural differences are very variable. Our patient population appears to be patients with a worse metabolic profile. The most complex patients followed in tertiary care may explain the poor metabolic profile.

If we look at the world data, in a study published by Si., *et al*. in 2010, 43% of patients with HbA1c levels above 7% were observed in the general population in Australia, and 73% of patients in New Zealand were found to have HbA1c levels below 8%, in the United States. It was observed that only 30% of patients aged between 18 and 75 years had HbA1c levels below 7% [17].

Our study found that glycemic (HbA1c) and lipid control (LDL+HDL), which we call triple metabolic control, was achieved in only 5,1% of the cases in the whole population. Sönmez., *et al*. included blood pressure regulation in their study [12] and found that 10,4% of the patient groups had glycemic, lipid control, and blood pressure control simultaneously. The difference between study rates was our HDL instead of the blood pressure parameter in Sönmez., *et al*. We may use a suitable parameter, and the low number of patients in glycemic control also leads to a low number of patients in triple metabolic control.

Our study examined diabetic patients in terms of nephropathy, which is one of the microvascular complications. For this purpose, we examined protein and creatinine values in patients' 24-hour urine or spot urine and blood creatinine values . We evaluated patients with proteinuria and elevated creatinine as developing nephropathy.

Concomitant hypertension was diagnosed in 42,6% of the cases in our study. When we examined the hypertension rate according to diabetes types, the diagnosis of accompanying hypertension was observed at a rate of 20,5% in Type 1 diabetes patients and 48,8% in Type 2 diabetes patients.

The strengths of our study are to reveal many problems that need to be overcome in order to improve diabetes care in Turkey, a country with a high prevalence of diabetes in Europe, and at the same time, with the data we obtained, where we are in the context of regulation of diabetes in our hospital, treatment regimens, accompanying metabolic problems and comorbidities.

Limitation of the Study

The limitations of our study are that we could not perform blood pressure measurements at home to see the rate of blood pressure regulation in patients diagnosed with hypertension accompanying diabetes due to patient incompatibility. Another limitation is that it includes a single center experience.

Conclusion

In conclusion, the number of patients who cannot reach the glycemic and metabolic control target values in diabetic patients is still very high despite new drugs. About half of the patients have chronic complications. New strategies are needed to achieve metabolic goals and reduce complications.

Conflict of Interest

The authors have no conflict of interest.

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