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Effectiveness of 3-day continuous glucose monitoring for improving glucose control in type 2 diabetic patients in clinical practice

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ABSTRACT

Effectiveness of 3-day continuous glucose monitoring for improving glucose control in type 2 diabetic patients in clinical practice.

BACKGROUND: The aim of this study was to investigate whether continuous glucose monitoring system (CGMS) might lead to improved glycemic control in patients with type 2 diabetes.

METHODS: We reviewed the medical charts of 172 patients who used the CGMS for 1 year starting in December 2008 and the records of 1,500 patients who visited their regular outpatient clinics during December 2008. Of these patients, a total of 65 CGMS patients and 301 regular outpatients (control group) were enrolled in the study after propensity score matching.

RESULTS: The CGMS group showed a significant improvement in the HbA1c level compared to the control group at 3 months (7.9%±1.6% vs. 7.4%±1.2%, P=0.001) and at 6 months (7.4%±1.2% vs. 7.9%±1.6%, P=0.010).

CONCLUSION: Using a 3-day CGMS was advantageous for improving glucose control in patients with type 2 diabetes and may help these patients to optimize glycemic control in clinical practice.

KEYWORDS : Continuous glucose monitoring

INTRODUCTION

The United Kingdom Prospective Diabetes Study has suggested that early intensive glucose control may be associated with reductions in microvascular and macrovascular complications [1]. Glycated hemoglobin (HbA1c) is the standard measure of average glycemic control; therefore, normalizing the HbA1c level is important for preventing diabetic complications in patients with type 2 diabetes. However, several studies have reported that postprandial hyperglycemia or fluctuation in glucose levels is an independent risk factor for chronic complications of diabetes [2,3]. Current diabetes care depends on measurements of HbA1c levels and self-monitored blood glucose (SMBG) levels to assess the quality of glycemic control and to adjust management. SMBG has been shown to be effective for improving glycemic control in patients with insulin treated type 2 diabetes mellitus [4]. However, the usefulness of SMBG in the management of patients with non-insulin treated type 2 diabetes mellitus is not convincing [5,6]. This is, in part, due to limited SMBG measurements and a lack of education. A method for continuous glucose monitoring (CGM) has recently been developed with the aim of evaluating detailed daily glucose profiles.

In the present study, we report our experience using CGMS in a single diabetes clinic. We investigated whether adjusting the DIABETIC TREATMENT regimens obtained from the CGMS information might lead to improved glycemic control in patients with type 2 diabetes compared to the control group.

METHODS

Subjects, material, and methods

We started using CGMS in our clinic for managing patients with type 2 diabetes mellitus in December 2008.

A total of 172 patients were started on the CGMS between December 2008 and November 2009. A total of 84 patients with type 2 diabetes were finally enrolled in the study. There were no significant differences in the clinical characteristics between the enrolled group and the excluded group of patients with type 2 diabetes during the CGMS period (data not shown).

Of the 1,500 patients screened, a total of 747 patients with type 2 diabetes were enrolled in the control group. There were significant differences in age, baseline HbA1c, and body mass index (BMI) between the CGMS and the control groups; thus, a propensity score matching analysis was performed. The final samples for the matched comparisons comprised 65 CGMS subjects and 301 control subjects.

Statistical analysis

The data are presented as the mean±standard deviation (SD) or median values (25th percentile to 75th percentile).

RESULTS

Baseline characteristics

The overall baseline characteristics of the CGMS patients and the control patients are shown in Table 1. There were significant differences between the CGMS group and the control group in terms of age, glycemic control status (HbA1c), BMI, and treatment modality. However, the baseline characteristics, including age, baseline HbA1c, and BMI, were not significantly different between the CGMS patients and the control patients after propensity score adjustment (Table 1).

Table 1: Baseline characteristics of CGMS and control groups

Characteristic	Eligible study sample			Propensity score matched sample		
	CGMS group (n=84)	Control group (n=747)	P-value	CGMS group (n=65)	Control group (n=301)	P-value
Age, yr	58.3±9.9	62.5±10.8	<0.001	59.0±10.0	59.1±11.0	0.945
Body mass index, kg/m²	25.9±3.5	25.0±3.5	0.017	25.9±3.3	25.7±3.3	0.925
Sex, female	29 (34.5)	329 (44.0)	0.105	18 (27.7)	89 (29.6)	1.000
Duration of diabetes, yr	11.4±6.8	12.7±7.9	0.163	11.9±6.9	11.4±7.3	0.628
HbA1c, %	8.1±1.6	7.6±1.3	0.001	7.9±1.5	7.9±1.6	0.939
Treatment						
OHAs	69 (58.3)	402 (54.1)	0.489	45 (69.2)	223 (74.1)	0.442
SU	33 (67.3)	245 (61.1)	1.000	29 (64.4)	141 (63.2)	1.000
Metformin	41 (83.7)	295 (73.6)	0.102	37 (82.2)	170 (76.2)	0.441
TZD	14 (28.6)	49 (12.2)	0.003	13 (28.9)	29 (13.0)	0.012
Glinide	0	20 (5.0)	0.250	0	9 (4.0)	0.364
AGI	10 (20.4)	128 (31.9)	0.579	8 (17.8)	62 (27.8)	0.195
DPP4 inhibitor	14 (28.6)	9 (2.2)	<0.001	7 (15.6)	4 (1.8)	<0.001
Basal insulin+OHAs	12 (14.3)	257 (34)	<0.001	11 (16.9)	41 (13.6)	0.556
Insulin twice a day	10 (11.9)	78 (10.4)	0.708	8 (12.3)	36 (12.0)	1.000
Multiple daily injection	6 (7.1)	11 (1.5)	0.004	1 (1.5)	1 (0.3)	0.324

Clinical outcomes

The CGMS results of 65 patients are shown in Table 2. The mean glucose value during CGMS was 157.7 mg/dL, and 24 patients (37%) experienced the hypoglycemia events during CGMS. Of these patients who experienced the hypoglycemic events, 15 patients (62.5%) were treated with OHAs and nine patients (37.5%) were treated with insulin therapy. Fourteen patients (93.3%) with OHAs changed the dose of OHAs after using CGMS (four patients reduced the dose of OHAs and 10 patients added the DPP4 inhibitors). Seven patients (77.7%) with insulin therapy changed the insulin regimen after using CGMS (from basal to biphasic or basal and prandial insulin regimen).

Table 2: Results of CGMS in 65 patients

CGMS parameter	All subjects
Mean glucose, mg/dL	157.7±49.0
SD of glucose, mg/dL	49.0±21.9
CONGA 24, mg/dL	49.2±19.9
MODD, mg/dL	46.9±20.8
Hypoglycemic events during CGMS, %	0.0 (0.0–3.0)

Tables 3 show the percentage of patients whose diabetic regimens were altered. In the insulin treated CGMS subgroup (*n*=20), five patients (25.0%) added or changed the dose of OHAs, eight patients (40%) received only education on insulin dose titration, and seven patients (35%) changed their insulin regimen (from basal to biphasic in one patient, from basal to basal and prandial in four patients, and from biphasic to basal and prandial in two patients).

Table 3: Recommended changes for DIABETIC TREATMENT regimens between the insulin treated CGMS and the insulin treated control subgroups after propensity score matching

Variable	CGMS group (*n*=20)	Control group (*n*=78)	*P* value
Change in insulin regimens	7 (35.0)	8 (10.3)	0.036
Adding or change in OHAs	5 (25.0)	4 (5.1)	0.012
No change in regimen	8 (40.0)	66 (84.6)	0.001

It recommended changes for diabetic treatment regimens between the insulin treated CGMS and the insulintreated control subgroups after propensity score matching

DISCUSSION

The results of the present study showed that using CGMS in clinical practice benefits the patients with type 2 diabetes. The glucose data from the CGMS revealed distinct glucose profiles that physicians can use to optimize patient therapy, leading to lifestyle changes and improved diabetic treatment regimens. We monitored patients for 6 months after CGMS use to determine if these alterations had contributed to sustained improvements in glycemic control, as assessed by the patients' HbA1c values. The patients' HbA1c values were improved at 3 months post CGMS and were sustained at 6 months.

A recent study has shown that the additional information provided by the CGMS did not result in improved HbA1c levels compared to the standard control group in patients with insulin treated diabetes [16].

Previous randomized, controlled trials have compared the effects of CGMS with those of frequent capillary monitoring for improving metabolic control and have studied the effects of additional information obtained from the use of CGMS with SMBG on the improvement of metabolic control [17,18]. In clinical practice, patients with type 2 diabetes practice SMBG less frequently than what is described as the recommended frequency [19]; in such cases, a CGMS is useful for educating and motivating for patients with type 2 diabetes in clinical practice.

Our study showed that the 3-day application of CGMS is useful in improving glucose control in clinical practice. CGMS represents a useful tool for optimizing glycemic control in clinical practice and in patients with type 2 diabetes.

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