

Fear of Hypoglycemia and Patient-Physician Communication in Adult Patients with Type 1 Diabetes Mellitus

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Abstract

Little is known regarding rates of fearing hypoglycemia and predictive factors in Japan. The aim of the study was to investigate the prevalence of a fear of hypoglycemia and predictive factors in patients with Type 1 Diabetes Mellitus (T1DM). A questionnaire survey on hypoglycemia and patient-physician communication was conducted in 197 patients with insulin-treated T1DM patients at 16 hospitals and clinics. The rate of fearing hypoglycemia was 22.1%. A multivariate-adjusted logistic regression analysis found that aging (Odds Ratio [OR]: 1.02; 95% Confidence Interval [CI]: 1.00-1.04; P=0.049) and Severe Hypoglycemia (SH) during the past 1 year (OR: 4.34; 95% CI: 1.45-13.00; P=0.009) were significant determinants of a fear of hypoglycemia. Patients with such a fear showed a significantly higher frequency of talking with physicians compared to patients without such a fear, but there was no difference in carrying a diabetic data book or the possession of glucagon. Interventions to reduce fears of hypoglycemia are needed in the future.

Keywords: Type 1 Diabetes; Hypoglycemia; Fear

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Introduction

The incidence of Type 1 Diabetes Mellitus (T1DM) is rising globally [1]. Hypoglycemia is a common complication of

insulin treatment in T1DM. Hypoglycemia can affect patients' daily lifestyles and activities [2, 3]. One of the factors with the greatest impact is patients' fear of severe hypoglycemic events, which is a limiting factor in the optimization of glycemic control [2, 3]. A history of frequent or traumatic hypoglycemia and anxiety are associated with a fear of hypoglycemia in both children with T1DM and their parents [4] and adults [5, 6]. These studies were previously performed in other countries excluding Japan. This may partly be due to the lower incidences of T1DM in Asian countries, including Japan, than in other areas such as European countries [1]. Therefore, little is known regarding a fear of hypoglycemia and patient-physician communication involving adult patients with T1DM in Japan. The whole of Japan is covered by medical services via employer-purchased insurance, and Japan's health care system is designed to control health care expenditure. This has resulted in one of the healthiest nations in the world at one of the lowest costs [7].

Studies should be promoted on fears of hypoglycemia in adult patients with T1DM in Japan. As an initial step, the aim of this study was to investigate the prevalence of a fear of hypoglycemia, in association with Severe Hypoglycemia (SH) and social factors, in adult patients with T1DM in Japan. Furthermore, we also investigated the association between a fear of hypoglycemia and patient-physician communication regarding hypoglycemia and strategies to avoid it.

Materials and Methods

Subjects

We recruited 197 adult patients with T1DM at 16 hospitals and clinics nationwide in Japan. Inclusion criteria were: 1) over 20 years, 2) type 1 diabetes [8], 3) insulin treatment, and 4) patients regularly attended the surveyed hospitals and clinics. Exclusion criteria were: 1) children and young patients under 20 years old, and 2) type 2 diabetes mellitus.

Table 1: Clinical data of patients with or without a fear of hypoglycemia

Variables	With fear of hypoglycemia (n=138)	Without fear of hypoglycemia (n=59)	P-value
Age, years	47.7 (15.0)	43.6 (15.9)	0.10
Male, %	34.8	45.8	0.15
Current smoker, %	26.8	24.1	0.86
Alcohol drinker, %	13.8	11.9	0.82
Single life, %	13.0	8.5	0.47
Married, %	76.1	67.8	0.29
Diabetes duration, years	13.4 (8.3)	13.5 (10.2)	0.92
Injection regimen			
1 time per day	0	0	0.38
2 times per day	4.1	4.2	
3 times per day	8.3	10.4	
≥4 times per day	87.7	85.5	
Daily insulin dose, units	0.66 (0.23)	0.67 (0.33)	0.83
Biguanides, %	2.2	3.4	0.64
Alpha-glucosidase inhibitor, %	8.9	8.6	1.00
Thiazolidine, %	1.5	1.7	1.00
Body mass index, kg/m ²	21.7 (2.7)	22.3 (2.7)	0.20
HbA1c, %	7.8 (1.19)	8.1 (1.4)	0.08
Patients with HbA1c <7%	73.9	71.2	0.73
Patients with HbA1c ≥9%	27.1	12.3	0.01
Retinopathy, %	21.5	22.0	1.00
Nephropathy, %	16.1	12.1	0.52
Neuropathy, %	28.6	15.5	0.07
Atherosclerosis, %	5.7	1.7	0.44
Hypoglycemia, times per month	6.6 (7.5)	4.7 (6.6)	0.07
Severe hypoglycemia	23.2	6.8	<0.01
Carrying diabetic data book, %	48.9	43.1	0.53
Possession of glucagon	17.5	13.6	0.49

Data are means (standard deviation) or percentage.

Ethics

The study was approved by the ethical committee of the National Hospital Organization Kyoto Medical Center.

Study measures

Clinical data such as the insulin regimen and diabetic complications were collected from their physicians. The self-administered questionnaire was distributed and retrieved between 2006 and 2010, as previously described [9]. Patients completed the questionnaire to assess hypoglycemia and patient-physician communication. Hypoglycemia was defined as blood sugar ≤ 50 mg/dL (2.8 mmol/L) or symptoms of dizziness, blurry vision, confusion, and/or sweating that the patient was able to resolve without assistance [10, 11]. Similar symptoms that required external assistance were defined as SH [12, 13]. A fear of hypoglycemia was assessed using a 5-point Likert scale (scored 1-5) [14]. The presence of a fear of hypoglycemia was defined as the highest and second highest quintiles. Favorable glycemic control to prevent diabetic complications was defined as HbA1c $< 7\%$ [15] according to the "Kumamoto declaration 2013". The median of the quarterly measured HbA1c levels in the intervention group was 7% compared with 9% in the control group according to the DCCT study [16]. In this study, poor glycemic control was defined as HbA1c $\geq 9.0\%$. Current smoking, alcohol drinking [17], the possession of glucagon, and carrying a diabetic data book stating "I HAVE DIABETES" was recorded. Patient-physician communication regarding hypoglycemia and strategies to avoid it was based on the answer categories "never" and "seldom" as poor communication, and "sometimes" and "often" as favorable communication, in response to "how often do you talk about hypoglycemia and strategies to avoid it with your physician?"

Statistics

Data are presented as the mean (Standard Deviation: SD) or percentage. Student's t-test or the chi-square test was used to compare data between the groups. Potentially significant variables ($P < 0.20$) after univariate intergroup comparisons were

assessed by multivariate-adjusted logistic regression analyses. The Odds Ratio [OR] and Confidence Interval [CI] were calculated. Statistical Package for the Social Sciences (SPSS ver. 20.0, IBM Corp., New York, USA) was used for these analyses. A two-tailed p-value < 0.05 was considered significant.

Results

A fear of hypoglycemia was reported in 27.7% of the patients. The rate of SH were significantly higher in patients with fear of hypoglycemia than in those without it (Table 1). There were no significant differences in clinical characteristics, such as the prevalence of hypoglycemia, an insulin regimen, or diabetic complications, between the patients with and without a fear of hypoglycemia.

A multivariate-adjusted logistic regression analysis revealed that aging (OR: 1.02; 95% CI: 1.00-1.04; $P = 0.049$) and SH during the past 1 year (OR: 4.34; 95% CI: 1.45-13.00; $P = 0.009$) were significant determinants of a fear of hypoglycemia. Concerning talking about hypoglycemia with physicians, patients with a fear of hypoglycemia showed a significantly higher frequency of talking with physicians compared to patients without such a fear (86.1 vs. 62.7%; $P < 0.01$, respectively), but there was no difference in carrying a diabetic data book or the possession of glucagon.

The rate of poor glycemic control in patients with a fear of hypoglycemia was significantly higher than in those without it, while there was no difference in the rate of favorable glycemic control between the groups.

Discussion

Main findings

The present study showed that SH during the past 1 year was associated with a fear of hypoglycemia in T1DM patients. Similar results were reported in previous studies of children with T1DM in other countries [18]. A fear of hypoglycemia is generally noted as one of the major barriers to achieving glycemic control [19, 20]. In this study, the rate of

poor glycemic control in patients with a fear of hypoglycemia was higher than in those without such a fear. In a previous study, the adjusted hazard ratio for mortality was 1.5 (95% CI: 1.1-2.1) for a 1% increase in the mean HbA1c level in a population-based cohort of childhood-onset T1DM [21]. Strategies to prevent SH, such as health education and talking about information on SH with physicians and health care providers, may be effective to reduce fears of hypoglycemia.

A fear of hypoglycemia is major barrier to achieve glycemic control in older patients with type 2 diabetes [22], while it remains unclear whether there is an association between aging and a fear of hypoglycemia in patients with T1DM. In this study, aging was associated with a fear of hypoglycemia. Sensor-Augmented Pump (SAP) therapy can improve glycemic control compared with multiple daily insulin injections or with insulin pump therapy alone, without increasing the risk of hypoglycemia. Factors associated with improvement in HbA1c after 12 months in patients were a high baseline HbA1c, an older age, and more frequent sensor use in the INTERPRET study with SAP therapy for T1DM [23]. SAP therapy may reduce a fear of hypoglycemia in patients. Further studies including SAP therapy are required to address these issues in the future.

The current survey found that patients with a fear of hypoglycemia showed a significantly higher frequency of talking with physicians compared to patients without such a fear. However there was no difference in carrying a diabetic data book or the possession of glucagon. Glucagon as a measure to treat severe hypoglycemia is under-utilized among T1DM patients in Japan. Good patient-physician communication focusing on the possession of glucagon and a diabetic data book may help to prevent SH and reduce fears of hypoglycemia.

Strengths and limitations

The strength of this study was the recruitment of patients at hospitals and clinics nationwide in Japan. Patients who regularly attended the medical facilities were recruited, so they could fully respond to the questionnaire. However, this study had

several limitations. The causes of the results cannot be determined because of the cross-sectional nature of the study design. The data were from a self-administered questionnaire, and we did not evaluate objective measures of blood glucose. These limitations should be addressed in future research.

In conclusion, a fear of hypoglycemia was associated with SH during the past 1 year. Fear of hypoglycemia is a barrier to good glycemic control in adult T1DM. Therefore, intervention study to reduce such fears through patient-physician communication focusing on the possession of glucagon and a diabetic data book are needed in the future.

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