

Fear of hypoglycemia and its determinants in insulin-treated patients with type 2 diabetes mellitus

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Keywords

Fear, Hypoglycemia, Insulin, Type 2 diabetes

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ABSTRACT

The aim of the present study was to investigate the prevalence of fear of hypoglycemia, in association with severe hypoglycemia and social factors, in insulin-treated patients with type 2 diabetes mellitus. A questionnaire survey on hypoglycemia and patient–physician communication was carried out in 355 patients with insulin-treated type 2 diabetes mellitus patients at 16 hospitals and clinics. A fear of hypoglycemia was reported by 27.7% of patients. A stepwise logistic regression analysis found that severe hypoglycemia during the past 1 year was a significant determinant of fear of hypoglycemia (odds ratio 2.16, 95% confidence interval 1.06–4.41; $P = 0.034$), and age (odds ratio 1.02, 95% confidence interval 1.00–1.05, $P = 0.038$) and living alone (odds ratio 1.93, 95% confidence interval 1.00–3.73, $P < 0.05$) were significantly higher in patients with fear of hypoglycemia than in those without it.

INTRODUCTION

The incidence of type 2 diabetes mellitus is increasing worldwide, and the International Diabetes Federation has warned of the sociomedical impact¹. Although glycemic control is required for managing type 2 diabetes mellitus, hypoglycemia with anti-hyperglycemic agents, especially insulin, limits the management of type 2 diabetes mellitus². Hypoglycemia is also a burden reducing the quality of life of type 2 diabetes mellitus patients³. Severe hypoglycemia (SH) can increase the fear of future hypoglycemic events. To try to reduce hypoglycemic events, many patients with type 2 diabetes mellitus maintain their blood glucose levels with a ‘safety margin’ (i.e., at higher than recommended values) and maintain hyperglycemia⁴. Thus, further studies are required regarding fear of hypoglycemia in patients with type 2 diabetes mellitus. The aim of the present study was

to investigate the prevalence of fear of hypoglycemia, in association with SH and social factors, in insulin-treated patients with type 2 diabetes mellitus.

MATERIALS AND METHODS

Participants

A cross-sectional survey was carried out across Japan, in which 840 questionnaires were handed out by doctors and sent by mail to research centers in Kyoto Medical Center. The questionnaires were completed anonymously. Overall, the response rate was 75% ($n = 630$). Type 1 diabetes mellitus ($n = 219$) and incomplete questionnaires ($n = 56$) were excluded.

We recruited 355 adult patients with type 2 diabetes mellitus at 16 hospitals and clinics nationwide in Japan. Inclusion criteria were: (i) aged over 20 years; (ii) type 2 diabetes mellitus; (iii) insulin treatment; and (iv) regularly attended the hospitals and clinics surveyed. Exclusion criteria were: (i) children and young patients aged under 20 years, and (ii) type 1 diabetes mellitus.

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Ethics

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

Study Measures

Clinical data, such as the insulin regimen and diabetic complications, were collected from the patients' physicians. The self-administrated questionnaire was distributed and retrieved between 2006 and 2010. Patients completed the questionnaire to assess hypoglycemia and the fear of it. 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 according to the definition of Treatment Guide for Diabetes of the Japan Diabetes Society^{5,6}. Similar symptoms that required external assistance were defined as SH^{7,8}. Fear of hypoglycemia was assessed using a five-point Likert scale (scored as 1–5)⁹. The presence of fear of hypoglycemia was defined as the highest quintile. Favorable glycaemic control to prevent diabetic complications was defined as hemoglobin A1c $< 7\%$ (52 mmol/mol)¹⁰ according to the 'Kumamoto declaration 2013.' Current smoking and alcohol drinking were recorded as previously shown¹¹. We used participants' responses to a question regarding the marital status, 'What is your marital status (married or unmarried)?'¹² and 'What is your life status (live alone or with someone)?'.

Statistical Analysis

Data are presented as the mean \pm standard deviation or percentage. Student's *t*-test or the χ^2 -test were used to compare data between the groups. Univariate logistic testing was used to screen for significant determinants of the outcomes. Factors with an associated *P*-value of less than 0.05 were entered into a stepwise backwards conditional multivariable logistic regression procedure. A stepwise logistic regression analysis model was used to identify significant determinants of the outcomes. The Statistical Package for the Social Sciences (SPSS version 20.0, IBM Corp., Armonk, NY, USA) was used for these analyses. A two-tailed *P*-value < 0.05 was considered significant.

RESULTS

A fear of hypoglycemia was reported by 27.7% of patients. Age, living alone, the diabetes duration and percentage of SH were significantly higher in patients with fear of hypoglycemia than in those without it. There were no significant differences in clinical characteristics, such as the prevalence of hypoglycemia, insulin regimen and diabetic complications, between the patients with and without fear of hypoglycemia (Table 1).

In univariate analysis, age (odds ratio [OR] 1.03, 95% confidence interval [CI] 1.01–1.05, *P* = 0.011), living alone (OR 2.05, 95% CI 1.08–3.89, *P* = 0.028), diabetes duration (OR 1.03, 95% CI 1.01–1.06, *P* = 0.017) and SH during the past 1 year (OR 2.49, 95% CI 1.24–4.98, *P* = 0.010) were significantly correlated with a fear of hypoglycemia. Non-severe hypoglycemia was not associated with a fear of hypoglycemia. A stepwise logistic regres-

Table 1 | Clinical data of patients with and without fear of hypoglycemia

Variables	With fear of hypoglycemia (n = 98)	Without fear of hypoglycemia (n = 257)	<i>P</i> -value
Age (years)	64.6 (11.9)	61.0 (11.8)	0.011
Male (%)	60.2	58.8	0.804
Current smoking (%)	23.5	21.4	0.674
Alcohol drinking (%)	15.3	12.1	0.416
Living alone (%)	19.4	10.5	0.026
Married (%)	78.6	83.3	0.303
Diabetes duration (years)	18.2 (11.1)	15.4 (8.9)	0.030
Injection regimen			
1 time per day	7.2	6.2	0.702
2 times per day	37.1	37.0	
3 times per day	34.0	29.6	
≥ 4 times per day	21.6	27.2	
Daily insulin dose (units)	0.44 (0.21)	0.44 (0.23)	0.931
Sulfonylureas (%)	17.0	11.4	0.166
Biguanides (%)	20.0	23.6	0.479
Alpha-glucosidase inhibitors (%)	20.0	16.7	0.469
Thiazolidine (%)	3.2	5.3	0.405
Body mass index (kg/m ²)	24.4 (3.8)	24.5 (4.4)	0.763
HbA1c (%)	7.6 (1.3)	7.6 (1.2)	0.850
Patients with HbA1c $< 7\%$	68.4	63.5	0.394
Retinopathy (%)	51.0	45.3	0.333
Nephropathy (%)	43.9	46.7	0.634
Neuropathy (%)	36.5	46.6	0.090
Atherosclerosis (%)	21.6	20.1	0.744
Hypoglycemia (times per month)	1.1 (2.0)	1.2 (1.9)	0.542
SH during the past 1 year (%)	17.3	7.8	0.008
Carrying diabetic data book (%)	38.5	32.9	0.325

Data are means (standard deviation) or percentage. HbA1c, hemoglobin A1c; SH, severe hypoglycemia.

sion analysis found that SH during the past 1 year was a significant determinant of fear of hypoglycemia (OR 2.16, 95% CI 1.06–4.41, *P* = 0.034), age (OR 1.02, 95% CI 1.00–1.05, *P* = 0.038) and living alone (OR 1.93, 95% CI 1.00–3.73, *P* < 0.05).

DISCUSSION

The present study showed that SH during the past 1 year was associated with a fear of hypoglycemia in insulin-treated adult patients with type 2 diabetes mellitus, a specific population that is required to achieve good glycaemic control using insulin therapy. Similar results were reported in previous studies of children with type 1 diabetes mellitus^{13,14} and patients with type 2 diabetes mellitus who did not always receive insulin therapy¹⁵.

'Fear' of hypoglycemia is generally noted to be one of the major barriers to achieving glycemic control^{16,17}, whereas control was required in the studied patients. Strategies to prevent SH, such as education on and talking about SH by physicians and healthcare providers, or the use of new agents causing fewer hypoglycemic events, might be effective to reduce fear of hypoglycemia.

Also, age and living alone were associated with fear of hypoglycemia in the present study. Age aggravates fears, such as fear of falling¹⁸. Living alone is a risk of coronary heart disease or mortality^{19,20}. Although it might be difficult, as a social action, living with family members and friends could partly contribute to a reduced fear of hypoglycemia.

A strength of the present 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, fear of hypoglycemia was associated with SH during the past 1 year, age and living alone in insulin-treated patients with type 2 diabetes mellitus. The results provide important data on fear of hypoglycemia among insulin-treated adult patients with type 2 diabetes mellitus, and show that strategies to lessen the fear of hypoglycemia are required to improve management of the disease.

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DISCLOSURE

The authors declare no conflict of interest.

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