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Abrupt Increase in Glucose Intolerance after Smoking Cessation Therapy: A Case Report

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Abstract

Smoking contributes to impaired glucose tolerance. Cigarette smokers generally gain weight after smoking cessation, and such weight gain is believed to contribute to the worsening of dyslipidemia and glucose intolerance. In the guideline for smoking cessation therapy in Japan, patients should be examined five times in a 12-week therapeutic period (on their first visit and after 2 [second visit], 4 [third visit], 8 [fourth visit], and 12 weeks [final visit] and treated for nicotine dependence. However, in the guideline, there is no description regarding the need to perform blood testing before and after smoking cessation treatment. We experienced the case of a 59-year-old man diagnosed with diabetes during his first visit to our smoking cessation clinic; his glucose intolerance worsened remarkably after smoking cessation therapy. He smoked 30 cigarettes per day for 41 years starting at age 18 years. His Fagerström Test for Nicotine Dependence score was 9 points. His body weight increased from 75 kg (body mass index [BMI]: 28.9 kg/m^2) at his first visit to 82 kg (BMI: 31.6 kg/m^2) 12 weeks after smoking cessation therapy (final visit to the smoking cessation clinic). The patient's hemoglobin A1c level worsened progressively after smoking cessation, increasing from 6.8% at his first visit to 9.1% 12 weeks after smoking cessation and 11.5% 5 months after smoking cessation. These findings suggest that blood testing is necessary before and 12 weeks after smoking cessation treatment, at least for obese patients with severe nicotine dependency.

Keywords

Diabetes, Glucose tolerance, HbA1c, Weight gain, Obesity, Smoking cessation, Dyslipidemia, Cardiovascular risks

Introduction

Smoking contributes to impaired glucose tolerance. The independent risk factors for type 2 diabetes mellitus (T2DM) include smoking, family history of diabetes, obesity, dyslipidemia, and hypertension [1]. Insulin sensitivity in patients with T2DM is decreased depending on the number of cigarettes smoked per day [2]. The odds ratio for the incidence of T2DM in smokers who consume > 21 cigarettes per day is 1.61 compared to that in nonsmokers [3]. Passive smoking also contributes to the worsening of glucose intolerance [4]. The mechanisms by which smoking increases the risk of T2DM are as follows: (a) smoking promotes abdominal obesity; (b) nicotine increases catecholamine and free fatty acid levels; (c) nicotine remarkably decreases insulin secretion and sensitivity as well as serum adiponectin levels.

Cigarette smokers are generally known to gain weight after smoking cessation, and such weight gain is believed to contribute to impaired glucose tolerance for approximately 3 years [5,6]. Greater weight gain following smoking cessation is known to increase the risk of worsened glucose intolerance [5,7,8]. The use of nicotine replacement therapy can minimize post-cessation weight gain [9]. However, significant body weight gain occurs during smoking cessation therapy in outpatient clinics, and such weight gain is associated with the worsening of glucose intolerance. The guideline for smoking cessation therapy in Japan stipulates that patients be examined five times in 12 weeks: i.e., during their first visit and 2 (second visit), 4 (third visit), 8 (fourth visit), and 12 weeks (fifth visit) thereafter. We experienced the case of a patient diagnosed with diabetes during his first visit to our smoking cessation clinic, and the patients experienced remarkable worsening of glucose tolerance after smoking cessation therapy. However, in the Japanese guideline for smoking cessation therapy, there is no description on the necessity to perform blood testing during smoking cessation therapy. The purpose of the present report is to discuss on a better protocol of safe smoking cessation treatment for patients with nicotine dependency.

Case Report

A 59-year-old man visited our smoking cessation clinic to receive smoking cessation therapy. He smoked 30 cigarettes per day for 41 years starting at age 18 years. He had a family history of T2DM (both parents). He had a personal history of colorectal cancer (underwent colostomy after surgery), varicose veins in his left limb, and hypertension. He had received treatment with amlodipine 5 mg/day and temocapril hydrochloride 2 mg/day for 3 years. He drank two bottles of beer daily. The physical examination on his first visit revealed the following findings: height, 161 cm; and weight, 75 kg (body mass index [BMI]; 28.9 kg/m^2). His weight was approximately 60 kg in his 20s and 30s, increasing gradually after marriage before being maintained at approximately 72-75 kg. The patient's blood pressure and pulse rate were 135/96 mmHg and 83 bpm, respectively. His expiratory carbon monoxide (CO) concentration was 9 parts

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per million (ppm). His Fagerström Test for Nicotine Dependence (FTND) and Tobacco Dependence Screener (TDS) score were both 9 (both scales range 0-10, with higher scores indicating more severe nicotine dependence). Although he had never been diagnosed with T2DM, his hemoglobin A1c (HbA1c) level was 6.8% at his first visit to our smoking cessation clinic. He also had dyslipidemia, as his serum low-density lipoprotein-cholesterol (LDL-C) and triglyceride levels were 171 and 170 mg/dl, respectively. He was treated with oral varenicline, and he quit smoking 3 days after his first visit. The patient's expiratory CO concentration was 1 ppm at his second visit. He did not resume smoking thereafter, and he completed the 12-week smoking cessation program. However, he exhibited increased appetite during therapy and consumed 5-7 meals per day in addition to a pack of candy. At his final visit to the smoking cessation clinic (12 weeks after his first visit), his HbA1c level had increased to 9.1%. Thus, he was prescribed an oral hypoglycemic agent acarbose 300 mg/day, but he exhibited poor compliance. He had difficulty performing exercise therapy because of the presence of a stoma. He underwent diet modification with assistance from a nutrition specialist, and he worked to decrease food consumption and avoid desserts. Although his weight decreased from a maximum of 85 kg to 78 kg at 5 months after his first visit, his HbA1c levels and serum LDL-C levels increased to 11.5% and 190 mg/dl, respectively. He was introduced to a diabetes specialist who prescribed rosuvastatin calcium 2.5 mg/day and oral hypoglycemic agents, glimepiride 1mg/day, sitagliptin phosphate hydrate 50 mg/day, and metformin 500 mg/day. He exhibited good treatment compliance, and his HbA1c level had decreased to 7.0 % at 9 months after his first visit.

Discussion

We experienced the case of a patient who exhibited a remarkable increase in body weight and worsened glucose intolerance after smoking cessation therapy. An elimination of the appetite-suppressing effects by nicotine result in an increase in calorie intake which can explain post-smoking cessation weight gain. Other factors which could contribute to an increase of calorie intake include improvements in taste and smell perception, and a desire to have something in the mouth. We previously have reported that smokers with higher nicotine dependence, as indicated by a higher FTND score, are more likely to gain weight after smoking cessation [10]. The patient's high FTND score of 9 points might explain his remarkable weight gain after smoking cessation.

Smoking is associated with metabolic syndrome, and it has been reported in Japan that smokers who consume > 31 cigarettes per day are 1.6-fold more likely to have metabolic syndrome than nonsmokers [11]. The mechanisms by which smoking can contribute to the development of metabolic syndrome are as follows: smoking increases cortisol secretion, unhealthy habits associated with smoking, such as overeating and a lack of exercise, cause visceral fat accumulation, smoking alters the secretion of cytokines or protein lipase from fat cells, and smoking induces abnormal glucose and lipid metabolism. In this case, it is considered that the patient's abnormalities at baseline, including visceral fat accumulation and abnormal glucose and lipid metabolism worsened after smoking cessation, and the prominent increase in the HbA1c level was probably associated with weight gain as a result of the patient's increased appetite. Body weight generally increases for approximately 3 years after smoking cessation [12], and there is a short-term worsening of glucose intolerance [5,6]. People with greater post-smoking cessation weight gain have a greater risk of glucose intolerance [5,7]. It is reported that when persons without diabetes stop smoking for > 4 years, even if they gain weight, there is a significant reduction in cardiovascular risk compared with that prior to smoking cessation; in addition, the reduction in cardiovascular risk increases with an increases duration of smoking cessation. In contrast, for persons with diabetes who quit smoking for > 4 years, there is a significant decrease in cardiovascular risk compared with that of current smokers only if their weight gain is < 5 kg [13]). It can be considered that stricter weight control could help patients to further decrease cardiovascular risk. It is known that an increase in appetite occurs predominantly in the first 6 months after quitting smoking and continues until approximately 1 year after cessation [14]. Therefore, it is necessary to prevent body weight gain, especially in the first year after quitting smoking. Glucose intolerance is not listed as a specific side effect of varenicline in the company's medication insert. [15] Moreover, it has been reported that the use of anti-smoking agents such as varenicline can prevent weight gain after smoking cessation compared with the case of ceasing smoking on one's own initiative. [16,9] There is no evidence to demonstrate significant differences in the degree of their effect to suppress weight gain between varenicline and nicotine patch [10,17]. Therefore, we did not consider to change agents on the way of our smoking cessation treatment.

In the guideline for smoking cessation therapy in Japan, there is no description regarding the need to perform blood testing before and 12 weeks after smoking cessation treatment. However, in our clinic, we recommended that patients undergo a blood test at their first visit to assess the possibility of worsening hyperlipidemia and glucose intolerance after smoking cessation. In this case, the patients had not been diagnosed with T2DM prior to attendance at the smoking cessation clinic, but impaired glucose tolerance was identified via a blood testing performed at his first visit. He experienced progressive worsening of T2DM during 12 weeks of smoking cessation treatment. These findings suggest that performing blood testing is necessary before and 12 weeks after smoking cessation therapy at least for obese patients with severe nicotine dependency, to ensure patients gain the maximum benefit from smoking cessation treatment. In addition, although oral hypoglycemic agents were prescribed after completing of 12 weeks of the standard smoking cessation program, this patient unfortunately exhibited poor compliance. It is considered that patients who experienced weight gain and/or exhibited worsening in the blood test data should be followed-up after the 12 weeks of smoking cessation program. Such patients should be referred to diabetes specialists as soon as possible if the worsening of glucose tolerance was found to be prominent.

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Ethical Statement

The authors declare that there are no conflicts of interest.

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