Onset of Ulcerative Colitis in a Patient with Type 2 Diabetes: Efficacy of a Plant-Based Diet for Both Diseases

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Abstract: No case has been reported in which ulcerative colitis occurred in a patient with type 2 diabetes mellitus and the patient was treated with a plant-based diet. A 56-year-old man with a 3-year history of diabetes noticed bloody stool about 2 months after his worst glycated hemoglobin A1c test. Endoscopy revealed diffuse inflammation in the rectum. He was diagnosed with ulcerative colitis (proctitis, mild severity). He underwent educational hospitalization. A plant-based diet (1400 kcal/day) was provided. The same dosage of metformin was continued, but no medication was prescribed for ulcerative colitis. At the end of hospitalization, fecal occult blood 271 ng/mL became negative. Glycated hemoglobin A1c 6.9% had decreased to 6.6%. Two months after discharge, glycated hemoglobin A1c decreased to normal for the first time in 3.5 years. Ulcerative colitis had been in remission without medication for one and a half years after the educational hospitalization. Thereafter, however, he experienced two flareups. Deterioration in glycated hemoglobin A1c preceded the flareups. We described a scarcely reported case in which ulcerative colitis occurred in a patient with diabetes and the patient was treated with a plant-based diet. The plant-based diet was effective for both diseases. It seemed that the status of diabetes influenced the onset and relapse of ulcerative colitis.

Keywords: case report; diabetes mellitus; diet; glycated hemoglobin A1c; onset; plant-based diet; therapy; ulcerative colitis

1. Introduction

Inflammatory bowel disease (IBD) has been common in wealthy nations since the latter half of the 20th century, and it has increased since the turn of the 21st century in newly industrialized countries, thereby making IBD a global disease [1]. Type 2 diabetes (T2D) was a disease of the rich in the past [2]. However, it became one of the fastest growing health challenges of the 21st century, with the number of adults with T2D more than tripling over the past 20 years [3]. In Japan, increased incidence of IBD was associated with dietary transition (westernization) during high economic growth (1960–1975) [4]. The prevalence of IBD was 0.00089% of the population in 1975 [4], and it increased to 0.2% in 2015 [5]. The prevalence of T2D was 0.2% of the population in 1975 [3], and it increased to 6.7% in 2017 [6]. Therefore, both diseases have similar epidemiology, and their increases are associated with the contemporary lifestyle.

There are inconsistent results with respect to whether IBD is associated with increased risk for T2D. In a UK and Denmark cohort, individuals with ulcerative colitis (UC) showed an increased incidence of T2D compared to controls [7,8]. On the other hand, such an increase was not observed in South Korean and Taiwanese studies [9,10]. Conversely, there is scant information on whether T2D is associated with increased risk for IBD. At any rate, an association between IBD and T2D has been reported in the literature [7–12]. We encountered such a patient.
A plant-based diet (PBD) reduces the risk of T2D, and it is effective in the treatment of T2D [13–15]. PBDs have been shown to be more effective for glycemic control than conventional dietary guidelines recommended by nation-level diabetes organizations [16–19]. The American Diabetes Association recommends a plant-based diet (vegetarian diet) as one of the recommended diets for diabetes [14]. PBD is recommended also in Canada [20].

The etiology of IBD is generally stated as unknown. However, we regard a westernized diet in an affluent society as a ubiquitous environmental factor among various environmental factors underlying IBD [21]. We developed a PBD, i.e., a lacto-ovo-semi-vegetarian diet, to counter the westernized diet, and we have provided it to all inpatients with IBD starting in 2003 [22]. The modality incorporating PBD brought far better outcomes than the current modality in both UC and Crohn’s disease (CD), irrespective of disease stage (active or quiescent) [22–26]. Therefore, we recommend PBD for IBD [27].

To the best of our knowledge, no case has been reported in which UC occurred in a patient with T2D and the patient was treated with PBD.

2. Case Presentation

A 56-year-old self-employed man noticed bloody stool in late April 2020. At the same time, he felt mild stabbing pain in the left lower quadrant of the abdomen. Endoscopy revealed diffuse inflammation with numerous petechiae without a normal vascular pattern in the rectum (Figure 1A,B). Histologic examination revealed moderate infiltration of lymphocytes, plasma cells, and neutrophils. Non-caseating epithelioid granuloma was not found. Although crypt abscess was not found, neutrophils infiltration into glandular crypt epithelium was found. These findings were consistent with mild inflammation of UC. Stool culture did not reveal any pathogen. He was diagnosed with UC (initial onset, proctitis, mild severity) and referred to us. He accepted our advice and was admitted for educational hospitalization [28] mainly for ulcerative colitis, and secondarily for T2D and weight loss.

His height was 171.3 cm and body weight had been around 86 kg (body mass index (BMI) 29.3 kg/m²) for decades. He had a gout attack in 2002, and since then he took allopurinol. In 2010, he was diagnosed with obstructive apnea syndrome. Thereafter, he continued overnight treatment with continuous positive airway pressure. There was no family history of IBD in 2020, but his younger sister was diagnosed with UC in 2021, 1 year after his UC diagnosis.

His glycated hemoglobin A1c (HbA1c) (National Glycohemoglobin Standardization Program: reference 4.6–6.2%) was normal until 2013 (Figure 2). Then it fluctuated between 6.2% and 6.5% for a few years, but it increased to equal to or more than 6.6% in 2018; thereafter, metformin (500 mg/day) was prescribed for T2D (Figure 2). After starting medication, HbA1c decreased in three consecutive blood tests (Figure 2). However, it
increased at each subsequent test up to a maximum of 7.3% in 2020 (Figure 2). Therefore, his physician (KH) warned him to drink less alcohol and eat less to reduce his body weight. He decreased his alcohol consumption from daily to twice a week. HbA1c decreased to 7.1% then to 6.9%. His body weight decreased to 84.2 kg (BMI 28.6 kg/m²). At 5 days prior to 6.9% HbA1c, he noticed bloody stool.

He was admitted for educational hospitalization for 9 days (Figure 2). On admission, he did not notice bloody stool. His weight was 82.1 kg (BMI 27.9 kg/m²). Physical examination was non-contributory, except for obesity. There was no abnormality in the following blood tests: total cholesterol, low- and high-density lipoprotein, serum albumin, uric acid, and C-reactive protein. Abnormalities were found in the following tests: HbA1c was 6.9% and triglyceride 343 mg/dL (reference 30–150). Fecal occult blood test was 271 ng/mL (<100).

PBD (1700 kcal/day), a lacto-ovo-semi-vegetarian diet with fish once a week and meat once every 2 weeks [22], was provided. Because inpatients were not allowed to go out for outdoor exercise due to COVID-19, the calorie count was decreased to 1400 kcal/day, and white rice was changed to brown rice on the 4th hospital day. Allopurinol, metformin, and overnight continuous positive airway pressure were continued. There was no medication for UC. On discharge, body weight, HbA1c, and triglyceride decreased to 81.3 kg (BMI 27.7 kg/m²), 6.6%, and 178 mg/dL, respectively (Figure 2). Fecal occult blood test became negative (68 ng/mL). He received dietary guidance on the PBD and was advised to continue the PBD after discharge [28].

In July 2020, 2 months after the discharge, HbA1c decreased to within the reference range for the first time since November 2015 (Figure 2). His body weight further decreased to 79.2 kg (BMI 26.9 kg/m²) (Figure 2). However, HbA1c increased above 6.6% for next half year without a rebound in body weight (Figure 2). His physician (KH) cautioned him against carelessness. He ate less and tried to increase his physical activity. Almost 1 year after the educational hospitalization, HbA1c reverted to within the normal range again without change in medication (Figure 2).

His plant-based diet score (PBDS), which evaluates adherence to PBD for Japanese patients with IBD [29] (a higher PBDS indicates greater adherence to the PBD), was 9 before admission and 35 during educational hospitalization. It was 24 at 13 months after discharge (Table 1).
Table 1. Chronological change of plant-based diet score (PBDS).

| Food Groups          | PBDS Scoring | PBDS Measured Score in the Present Case |  |
|----------------------|--------------|----------------------------------------|---|
|                      | Frequency of Consumption | Base (Before Hospitalization) | Educational Hospitalization (9 Days) | 13 Months after Discharge |
|                      | Daily /wk | 3–5 Times /wk | 1–2 Times /wk | Rarely /wk |                     |                          |                          |
| Vegetables           | 5          | 3               | 1               | 0               | 1                     | 5                        | 3                        |
| Fruits               | 5          | 3               | 1               | 0               | 1                     | 5                        | 0                        |
| Pulses               | 5          | 3               | 1               | 0               | 1                     | 5                        | 1                        |
| Potatoes/starches    | 5          | 3               | 1               | 0               | 1                     | 5                        | 0                        |
| Rice                 | 5          | 3               | 1               | 0               | 5                     | 5                        | 5                        |
| Miso soup            | 5          | 3               | 1               | 0               | 5                     | 5                        | 5                        |
| Green tea            | 5          | 3               | 1               | 0               | 0                     | 0*                       | 5                        |
| Yoghurt (plain)      | 5          | 3               | 1               | 0               | 3                     | 5                        | 5                        |
| Meat                 | −5         | −3              | −1              | 0               | −1                    | 0                        | 0                        |
| Minced or processed meat | −5     | −3              | −1              | 0               | 0                     | 0                        | 0                        |
| Cheese/butter/margarine | −5     | −3              | −1              | 0               | −1                    | 0                        | 0                        |
| Sweets/ice cream/milk shake | −5     | −3              | −1              | 0               | 0                     | 0                        | 0                        |
| Soft drinks (cola/carbonated beverages/juice) | −5 | −3 | −1 | 0 | 0 | 0 | 0 |
| Alcohol              | −5         | −3              | −1              | 0               | −1                    | 0                        | 0                        |
| Bread                | −5         | −3              | −1              | 0               | −1                    | 0                        | 0                        |
| Fish                 | −2         | −1              | 0               | 0               | −2                    | 0                        | 0                        |

* Green tea is recommended to drink at home but is not provided as a drink at the hospital.

About one and a half years after the discharge, he experienced bloody diarrhea 5–6 times/day (Figure 2). Sulfasalazine was administered, resulting in rapid remission. However, it was discontinued 7 days later due to gastric distress followed by typical adverse reactions to sulfasalazine, i.e., fever and generalized eruption. Three months later, he had another flareup (Figure 2). Ultrasonography did not show the wall thickness of the colon, indicating the absence of substantial extended inflammation beyond the rectum. Mesalazine rapidly induced remission in several days. He stated that he wanted to adhere to PBD, and he had taken meals as usual, but he might have been careless before the two flareups. HbA1c deteriorated before the flareups (Figure 2). There was no rebound in weight (Figure 2). No adverse or unanticipated events related to the PBD were observed over the course of treatment.

3. Discussion

We described a scarcely reported case in which UC occurred in a patient with T2D and the patient was treated with a plant-based diet. The PBD provided during educational hospitalization was effective for both diseases as expected. At the end of hospitalization, the amount of fecal occult blood decreased to a normal level. There was an improvement in HbA1c and BMI. Two months after discharge, HbA1c decreased to normal (5.8%) for the first time in 3.5 years.

The incidence of diet-related obesity and chronic diseases, including T2D, coronary heart disease, stroke, metabolic syndrome, and non-alcoholic fatty liver disease, has been steadily increasing and is a global health concern [30]. Classic socioeconomic transition toward an affluent society inevitably induces a dietary transition (westernization) [31,32]. However, the development of a food industry that produces foods rich in fats at low cost and urbanization have induced similar dietary westernization in lower-income countries [32]. Therefore, dietary westernization has occurred or is occurring all over the world. The
transition has taken place in a shorter time in developing countries than in developed countries [32,33].

Current global consumption consists of an excess of unhealthy foods, such as red meat, sugar, and refined grains, and a shortage of healthy foods, such as vegetables, fruits, legumes, whole grains, and nuts [30]. This means that the current omnivorous (westernized) diet is problematic and should be corrected. Recent basic research clarifying an interrelationship between diet, gut microbiota, microbial metabolites, and health/disease has shown that current eating habits are pro-inflammatory, while PBD is anti-inflammatory [34–37]. Common features of consequences underlying the pathophysiology between IBD and T2D have been pointed out: gut dysbiosis, disrupted intestinal barrier function, close contact with pathogens followed by translocation of pathogens, increased pro-inflammatory cytokines and oxidative stress, endotoxemia, and low subclinical inflammation [38]. It is of note that symptoms of UC appeared 2 months after the highest HbA1c test result (Figure 2). In addition, two flareups occurred after deterioration of the HbA1c level (Figure 2). It seems that the status of T2D influences the onset and relapse of UC.

It is common that weight loss or decrease in HbA1c is greatest during or immediately after dietary intervention, but thereafter it increases toward the baseline in the long term (1 year). HbA1c was found to increase with either PBD or a diabetic diet [17,18]. It is remarkable that his HbA1c reverted to normal in our case, even in the long term (1 year) after educational hospitalization as a result of a lifestyle change by himself, not a change of medication (Figure 2). There was no rebound in body weight (Figure 2). He moderated all risk foods for Japanese patients with IBD (Table 1). The educational hospitalization seemed to enhance his awareness and perception of PBD, which resulted in the enhancement of his self-management skills.

A sister of the present patient was also affected by UC despite the rate of familial aggregation of IBD being low in Japan compared with other countries [39]. Therefore, it is anticipated that a genetic factor contributed more to the onset and clinical course in this patient than the average Japanese patients. However, a genetic study was not performed in this case.

In conclusion, we described a scarcely reported case in which UC occurred in a patient with T2D and the patient was treated with a plant-based diet. The PBD was effective for both diseases. Nowadays, it is apparent that current omnivorous diets cause the diet-related common chronic diseases, such as metabolic syndrome, T2D, coronary heart disease, stroke, and non-alcoholic fatty liver disease. We believe that IBD is not an exception. Basic medicine has supported the epidemiologic data of PBD over current westernized diets in health: current westernized diets are pro-inflammatory, while PBDs are anti-inflammatory. Greater appreciation of diet by care providers will change and improve the management of chronic diseases, including IBD and T2D.

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Abbreviations

BMI  Body mass index
CD  Crohn’s disease
HbA1c  Glycated hemoglobin A1c
IBD  Inflammatory bowel disease
PBD  Plant-based diet
PBDs  Plant-based diet score
T2D  Type 2 diabetes
UC  Ulcerative colitis

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