

Relieved Type 2 Diabetes (T2D) By Petite Low Carbohydrate Diet (LCD), Equmet and Twymeeg

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Article Info

Article History:

Received: 17 August, 2024

Accepted: 24 August, 2024

Published: 31 August, 2024

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770-0943 Japan; DOI:
<https://doi.org/10.36266/JBSR/191>

Abstract

The case is 53-year-old female with Type 2 diabetes (T2D). She felt thirsty, polydipsia, polyuria from April 2023, and was diagnosed as T2D in June 2023 with HbA1c 13.7%. She began petite Low Carbohydrate Diet (LCD) and continued the diet therapy. She took metformin and vildagliptin (EquMet) resulting HbA1c 7.9% in October 2023. She added imeglimin (Twymeeg) and Empagliflozin (Jardiance) resulting HbA1c 6.9% in August 2024. Pulse wave velocity (PWV) showed ankle brachial index (ABI) 1.09, cardio-ankle vascular index (CAVI) 10.7, indicating arteriosclerosis. Consequently, clinical progress seems to be satisfactory with efficacy of LCD, EquMet, Twymeeg and Empagliflozin.

Keywords: Imeglimin (Twymeeg); Pulse wave velocity (PWV); Japan LCD promotion Association (JLCDPA); Metformin and vildagliptin (EquMet); Petite Low Carbohydrate Diet (LCD)

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Introduction

For some decades, type 2 diabetes (T2D) has become the crucial medical problem in the world [1]. In several regions, diabetic management has attracted attention, especially in North American and European countries [2,3]. For the standard T2D guideline, American Diabetes Association (ADA) has presented adequate management methods [1]. Recent topics would include previous and novel types of oral hypoglycemic agents (OHAs) that show beneficial efficacy in the actual clinical practice. Among them, metformin has been the first-line agent and imeglimin (Twymeeg) has been novel agent with several pharmacological mechanism via mitochondria pathway [4]. Authors and collaborators presented several articles about T2D associated efficacy by imeglimin (Twymeeg) and metformin/vildagliptin (EquMet) [5]. Concerning T2D, fundamental treatment principle includes diet therapy, exercise and OHA or injection. As nutritional treatment, calorie restriction (CR) was previously standard measure, but low carbohydrate diet (LCD) and Mediterranean Diet (MD) have been known for adequate method [7]. LCD was initiated by Bernstein and Atkins through health care region and educational books [8,9]. After that, LCD was also started in Japan, where the authors' co-researchers have developed medical and social movement through the activity of Japan LCD promotion Association (JLCDPA) [10,11]. Furthermore, our LCD team continued LCD education by books, seminars and papers [12].

We have shown actually 3 types of LCD meals in various opportunities. They include super LCD (12%), standard LCD (26%) or petite LCD (40%), that indicates carbohydrate ratio for calorie base, respectively [13].

During our various diabetic practice and research for long, a meaningful T2D female case was found. She has recently developed the onset of T2D, and continued petite LCD. HbA1c showed remarkable improvement by LCD and OHAs, including EquMet and Twymeeg. Her general clinical progress and some perspectives would be shown in this paper.

Presentation of Cases

History And Physicals

The current case is 53-year-old female with T2D. She did not have specific past medical history. She felt thirsty, polydipsia, polyuria from April 2023, and visited our hospital in June 2024. Laboratory exams have shown extremely high values of HbA1c 13.7% and postprandial glucose 402 mg/dL (Figure 1). She was diagnosed as T2D.

By interviewing and consulting the detail lifestyle together, the treatment strategy was decided according to her situation, hope and medical needs for treatments. She cannot start super-LCD, because she wanted to have regularly certain carbohydrate amount per day. Then she began petite LCD, in which she can limit carbo food to some degree.

The physical examination in June 2023 showed as follows: Speech, consciousness, and vital signs were unremarkable, in which pulse 76, BP 138/86, SpO2 98%. Her heart, lung, abdomen and extremities were negative. Her physique was height 162.4 cm, weight 64.0 kg and BMI 24.3 kg/m². Her chest X-ray was negative, and electrocardiogram (ECG) was within normal limits.

Clinical Progress and Exams

After she was diagnosed as T2D, she was advised to start petite LCD and take oral hypoglycemic agents (OHAs) from June, 2023 (Figure 1). For OHAs, metformin and vildagliptin (EquMet) was provided, which showed remarkable HbA1c decrease from 13.7% to 7.9% for 4 months. During October to June 2024, her HbA1c maintained almost stable, but it was not ideal level. From June

2024, she was started Empagliflozin (Jardiance), and HbA1c was decreased to 6.9% in August, 2024. For 14 months, her body weight decreased from 64kg to 58 kg.

Biochemical tests were summarized in Table 1. The first data in June, 2023 showed no specific abnormal results. She received liver, renal and lipid exams three times every half year. Among them, γ -GTP (GGT) and triglyceride (TG) levels showed decreased values, in which these data are indicated.

She received pulse wave velocity (PWV, sphygmograph) exams twice in June 2023 and August 2024. For these data, ankle brachial index (ABI) and cardio-ankle vascular index (CAVI) showed existing of arteriosclerosis to some degree (Figure 1, 2).

Table 1: Changes in biochemistry results.

	2023 Jun	2023 Dec	2024 Jul	Units
Liver				
AST	12	11	14	(U/L)
ALT	12	13	13	(U/L)
GGT	22	16	13	(U/L)
Renal				
UA	3.7	5	6.3	(mg/dL)
BUN	12	16	17	(mg/dL)
Cre	0.39	0.64	0.85	(mg/dL)
Lipids				
HDL	55	67	59	(mg/dL)
LDL	198	155	159	(mg/dL)
TG	310	210	151	(mg/dL)
CBC				
WBC	63	66	72	(x10 ³ / μ L)
RBC	518	445	455	(x10 ⁴ / μ L)
Hb	15.2	13.2	13.2	(g/dL)
PLT	18.9	20.1	22.5	(x10 ⁴ / μ L)

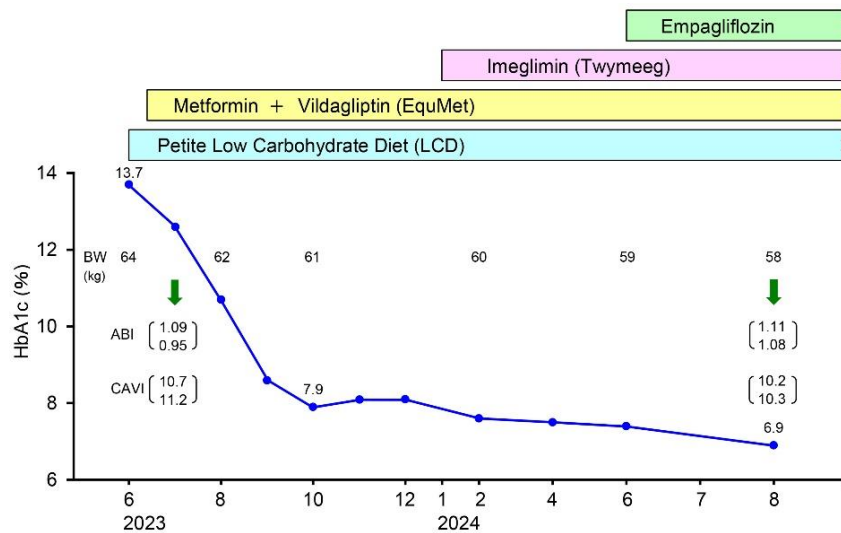


Figure 1: Clinical progress of current case.

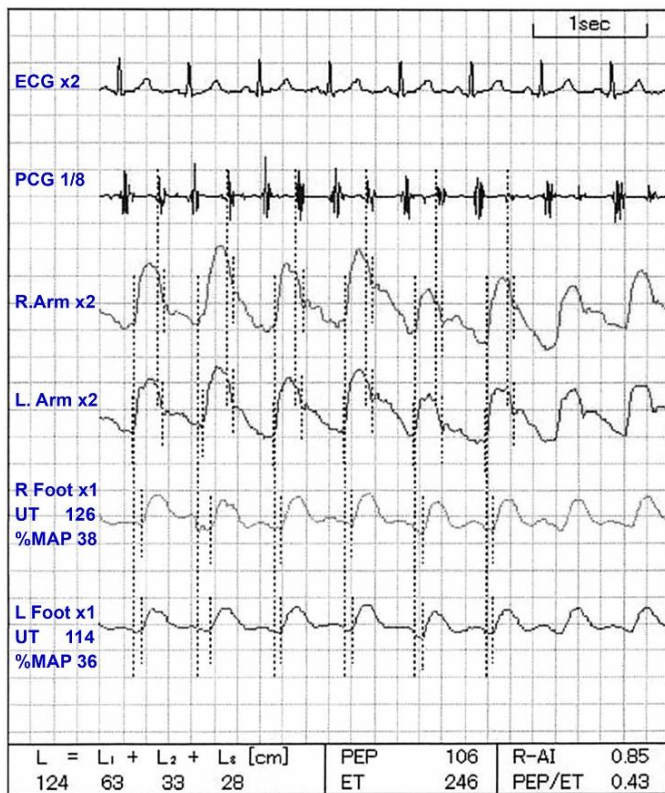


Figure 2: Pulse wave velocity (PWV) test.

Ethical Standards

This article is complied with the ethic guideline for Declaration of Helsinki [14]. In addition, some comments are along with the protection regulation for information. The principle is accompanied with ethical regulation for clinical research and practice. The guideline has been found as Japanese Ministry, that is from Ministry of Education, Culture, Sports, Science Technology (MEXT) and Ministry of Health, Labor and Welfare (MHLW) of Japan.

The authors et al. established the ethical committee in the hospital. It included hospital president, physician, pharmacist, nurse, nutritionist, and legal professional. The members have discussed the protocol enough and agreed for the content. The informed consent was taken from the current case by the document.

Discussion

This case is 53-year-old patient with T2D, where this is the first onset of T2D. She was not pointed out to have hypertension, dyslipidemia, or other arteriosclerotic diseases before. She did not have neuropathy, nephropathy, retinopathy or other macroangiopathy. For initial treatment, she started petite LCD, followed by some kinds of OHAs such as metformin, vildagliptin, imeglimin and empagliflozin [15]. This combination seemed to be effective for general improvement of T2D.

Historically, a study comparing LCD, CR, and Mediterranean Diet (MD) is known [16]. LCD is effective in the short term, but it is not easy to continue [17]. Consequently, some researchers

have recommended the combination of LCD and MD, in which LCD is begun at first, and after that inverted to MD. [7]. Furthermore, recent topics include the comparison of the following diet measures, which are Mediterranean diet and Paleolithic diet [18].

On the other hand, in this case, strict dietary restrictions were not implemented from the beginning, and petite LCD was continued throughout. For the first four months, the patient was treated with mild LCD and EquMet, and a remarkable effect was observed, with HbA1c dropping from 13.7% to 7.9%. For one of the reasons, she seemed to refrain from carbo of snacks, and the improvement of lifestyle can contribute successful treatment.

Furthermore, another reason for remarkable improvement may be the administration method of EquMet. The case continued petite LCD, in which she has always taken certain amount of rice every night. As EquMet has been provided twice per day, clinical effect was reported to be more than other DPP4-i agents giving once per day. For this merit, research-oriented evidence has been observed, where suppressing daily glucose fluctuation could be obtained for 24 hours with less mean amplitude of glycemic excursions (MAGE) [19]. The result has revealed enough suppressed glucose variability during midnight by giving EquMet at the evening. Similarly, this case presented remarkable HbA1c decrease for short period by EquMet. It may be due to the combination of vildagliptin and metformin for bid administration. It is likely large benefit in comparison with other DPP4-i agents by once per day.

Authors et al. have continued so far diabetic research and practice for several patients [20]. Among various reports, similar case associated with arteriosclerosis was reported by effective therapy of EquMet [21,22]. We have also analyzed seasonal changes of HbA1c for patients treated with EquMet for years [23].

Certain limitation may exist in this report. Current case is female T2D patient who had diabetic onset in this episode. She did not present specific microangiopathy or macroangiopathy so far, but we have to follow up the case with careful attention for aggravating diabetic complication. Important direction would be to prevent the development of Atherosclerotic Cardiovascular Disease (ASCVD) in the future [24].

In summary, 53-year-old female was investigated for the onset of T2D. She showed remarkable improvement by petite LCD, EquMet and Twymeeeg. The case will be followed up from diabetic and arteriosclerotic points of view. It is expected that current report will become the useful reference in the future.

Conflict of Interest: The authors declare no conflict of interest.

Funding: There was no funding received for this paper.

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