



An Elderly Male with Cardiovascular and Diabetic Control by Low Carbohydrate Diet (LCD) and Ideal Life-Style Continuation for Years

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Abstract

The patient was an 81-year-old man with type 2 diabetes (T2D), hypertension, and hyperuricemia for several years. He was treated with a low-carbohydrate diet (LCD), sitagliptin, nifedipine, and febuxostat. Pulse wave velocity (PWV) showed an ankle-brachial pressure index (ABI) of 1.29/1.33 and a cardio-ankle vascular index (CAVI) of 10.1/10.2 (right/left), which were within the normal range for his age. Biochemical examinations were unremarkable, with low coefficients of variation (CV) observed in red blood cell (RBC) count, hemoglobin (Hb), HbA1c, platelet count, creatinine, and HDL, ranging from 2.6% to 6.3%. The probable reasons for his stable clinical progress include a highly regular lifestyle and psychologically satisfying interpersonal relationships, following the principles of Hinohara-ism.

Keywords

Coefficient of Variation, Pulse Wave Velocity, Low Carbohydrate Diet, Japan LCD Promotion Association, Hinohara-ism

Abbreviations

CV: Coefficient of Variation; PWV: Pulse Wave Velocity; LCD: Low Carbohydrate Diet; JLCDPA: Japan LCD Promotion Association

Introduction

Clinical problem of atherosclerotic cardiovascular disease (ASCVD) has been crucial for management and protection across the world [1]. Furthermore, recent increasing prevalence of type 2 diabetes (T2D) is the fundamental issue for developed and also developing countries [2]. T2D has microangiopathy and

macroangiopathy, and the latter includes cerebral vascular accident (CVA), cardiovascular disease (CVD), and peripheral artery disease (PAD). ASCVD includes wide diseases of cardiovascular problems, which are diabetes, hypertension, hyperuricemia, and dyslipidemia [3]. These diseases are included in the metabolic syndrome (MetS), and some studies have

been found from the National Health and Nutrition Examination Survey (NHANES) [4].

Among them, relationship has been observed between the presence of hypertension and hyperuricemia. From the latest report, people with middle to high age population showed hypertensive state in about 40% [5]. They show mutual influence for hyperuricemia, hypertension, and uric acid to HDL ratio (UHR). These situations may predict future exacerbation to diabetes and MetS [6]. Consequently, these diseases seem to develop ASCVD with aggravated arteriosclerosis during several years, leading to the influences on morbidity and mortality.

Authors and colleagues have been involved in clinical research and practice for various patients with ASCVD [7]. Among them, we have treated patients of T2D and obesity by low carbohydrate diet (LCD), which was started by Dr. Bernstein in Western countries and Dr. Ebe in Japan [8,9]. LCD can be applied to not only ASCVD patients, but also gestational diabetes associated

with clinical effects [10]. The effective diet method of LCD has been developed and informed broadly through the activities of Japan LCD Promotion Association (JLCDPA) [11].

During our daily medical practice for various patients in the primary care setting, we have managed a stable elderly male case with T2D, hypertension, and hyperuricemia by continuing LCD for years. His general clinical progress will be described associated with related perspectives in this article.

Presentation of Case

History and Physicals:

This case has been an 81-year-old elderly male with T2D, hypertension, and hyperuricemia for more than 10 years. When he was 69 years old, he was pointed out to have diabetic condition by the regular yearly health check-up. He visited our internal medicine department and was diagnosed as T2D, with elevated HbA1c 8.0%. He was advised to start LCD at once, so as to improve the glucose variability.

Table-1: The Results of Biochemistry with Statistical Analyses

	Units	2019		2020		2021		2022		2023		2024	Average (each unit)	STDEV (each unit)	STDEV/Ave (value)	CV (%)
		Jan	Jul	Jan	Jun	Apr	Sep	Mar	Dec	May	Oct	Jul				
Liver																
AST	(U/L)	23	23	24	25	23	19	22	27	22	22	19	22.6	2.3	0.1032	10.3
ALT	(U/L)	25	27	25	21	23	19	27	30	22	24	18	23.7	3.6	0.1521	15.2
GGT	(U/L)	24	22	23	23	21	18	21	23	20	22	17	21.3	2.2	0.1032	10.3
Renal																
UA	(mg/dL)	5.3	6.4	5.6	4.2	3.5	4.8	4.6	4.8	4.8		5.0	4.9	0.8	0.1592	15.9
BUN	(mg/dL)	16	16	19	12	16	21	25	16	18		19	17.8	3.5	0.1978	19.8
Cre	(mg/dL)	0.99	0.96	0.96	0.84	0.94	1.04	1.01	1.01	0.90	0.93	1.02	0.964	0.0592	0.0614	6.1
Lipids																
HDL	(mg/dL)	50	45	46	51	44	46	50	54	46	47	48	47.9	3.0	0.0629	6.3
LDL	(mg/dL)	115	114	115	120	121	146	150	58	125	124	134	120.2	24.0	0.1994	19.9
TG	(mg/dL)	59	62	76	88	54	66	67	55	57	74	73	66.5	10.5	0.1583	15.8
CBC																
WBC	(x10*2/μL)	53	63	73	63	69	70	70	76	77	67	80	69.2	7.6	0.1104	11.0
RBC	(x10*4/μL)	460	449	456	463	433	445	463	477	449	466	449	455.5	12.0	0.0264	2.6
Hb	(g/dL)	14.7	14.2	14.6	14.8	13.5	14.4	14.8	15.3	14.1	15	14.8	14.6	0.5	0.0338	3.4
PLT	(x10*4/μL)	18.8	16.3	18.5	17.5	17.2	17.8	18.4	17.3	19.2	18.6	19.3	18.1	0.9	0.0518	5.2
Diabetes																
HbA1c	(%)	5.5	5.6	5.5	5.7	6.0	5.6	5.8	6.1	5.7	5.8	6.1	5.76	0.22	0.0382	3.8
Immunol.																
CRP	(mg/dL)	0.11	0.39	0.20	0.06	0.66	0.11	0.09				0.08	0.2125	0.2100	0.9883	98.8

Case Report

Concerning his actual clinical progress, he started almost complete super-LCD for nutritional treatment, and continued the almost complete regular lifestyle, including taking a walk about 1 hour every day. Thus, he has continued satisfactory physical and psychological situation for years.

His physical examination revealed as follows: consciousness, speech, and mutual conversation have been normal. Vital signs have been unremarkable for BP 132/80, pulse 64/min, and SpO₂ 99%. His stature showed 168 cm in height, 70.0 kg in weight and BMI 24.9 kg/m². His face, head, neck, lung, heart, and abdomen showed negative, and neurological exams were intact. He did not have any particular symptoms or signs as before.

Several Exams:

His biochemistry results for years have been summarized in **Table-1**. He showed almost normal ranges of liver function, renal function, lipids, and complete blood count (CBC). For glucose variability, his HbA_{1c} values have been almost within normal ranges for all year round. For these biochemical data, some statistical calculation was tried for average value (Av), and standard deviation (SD) associated with the degree of changing data for Coefficient of Variation (CV) ($SD/Av \times 100$) in Table 1. As a result, the values of CV revealed the following: RBC 2.6%, Hb 3.4%, HbA_{1c} 3.8%, Platelet 5.2%, Cr 6.1%, and HDL 6.3%.

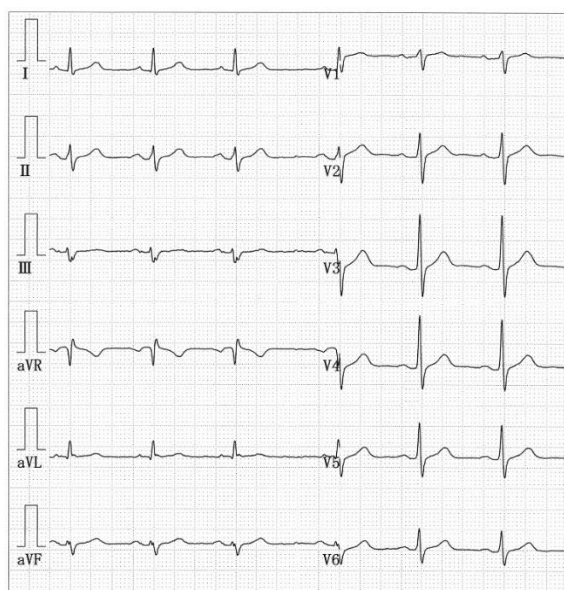


Fig-1: Electrocardiogram (ECG) Findings

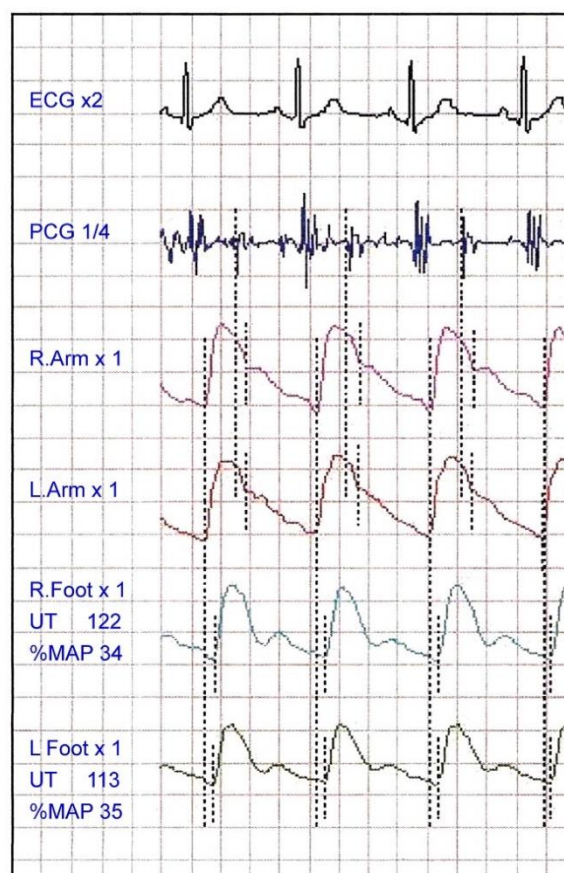


Fig-2: Pulse Wave Velocity (PWV) Exam for ABI

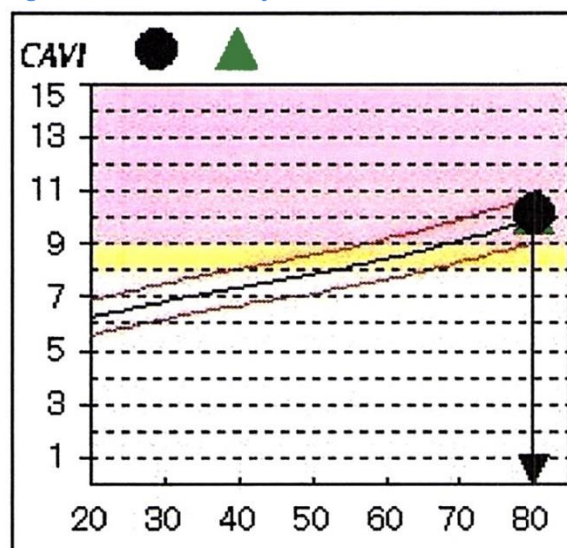


Fig-3: Normal Range of CAVI for the Age

As basic exams, chest X-ray revealed unremarkable, and electrocardiogram (ECG) showed regular rate rhythm (RRR), ordinary sinus rhythm (OSR), without remarkable ST-T changes (**Fig-1**). By Pulse wave velocity (PWV) exam, ankle brachial pressure index (ABI) showed 1.29/1.33 (right/left) as unremarkable results [12] (**Fig-2**). For arteriosclerosis, cardio-ankle vascular index (CAVI) showed 10.1/10.2 for standard

range as his age (**Fig-3**). The detailed results of PWV showed that PEP 85, ET 281, R-AI 0.77, and PEP/ET 0.31, and $L(129) = L1(66) + L2(34) + L3(29)$ [cm].

Clinical Course

Current case has been almost stable for his own symptoms, signs, and certain main laboratory results. Since he has three clinical problems of T2D, hypertension, and hyperuricemia, he has continued three oral medicines for years which are sitagliptin phosphate hydrate 50 mg, nifedipine controlled release (CR) 10 mg and febuxostat 20 mg per day. As a whole, his general clinical course has been stable in the light of complaints, medical problems, and treatments for years.

Ethical Standards

Current patient has complied with the guideline of the Declaration of Helsinki [13]. The principle has been evaluated by ethical regulation for clinical research. Current guideline was shown by the Japanese government from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and Ministry of Health, Labor and Welfare (MHLW). Authors and collaborators set up the ethical committee in the hospital, which includes the director of the hospital, doctors, head nurse, pharmacist, dietitian, and legal professional. These staff had adequate discussion for this protocol and agreed in a satisfactory manner. Informed consent document has been provided by the patient.

Discussion

The characteristic points of this case can be summarized in the following: i) medical problem included T2D, hypertension, and hyperuricemia, ii) these are controlled by three oral medicines for years, iii) daily meal has been on the degree of almost super-LCD, iv) exercise and sleep habits are nearly ideal—walking for 1 hour, regular rhythm activities, and sound sleep for 7 hours, v) his profession is the president of a company for production of hand gloves, and maintained good relationship with his employees, and vi) he has lived his daily life in accordance with Hinohara-ism, which is based on pursuing satisfactory human communication and relationships, leading to each well-being and happiness.

As medical problems of the case, certain association has been observed in arteriosclerosis and uric acid levels. By the exam of brachial-ankle pulse wave velocity (baPWV), arterial stiffness (AS) can be evaluated in each patient [14]. A significant correlation was reported between them, where baPWV is elevated by 0.52 cm/sec as UA is elevated by 0.055 mg/dL (1 mmol/L). The relationship between CVA and hyperuricemia has been in discussion. Meta-analyses were performed from 770 thousand cases in 22 reports for several kinds of risks [15]. The results showed relative ratio (RR) 1.42 for stroke incidence and RR 1.53 for stroke mortality. Furthermore, detailed analyses showed 1.67 for stroke incidence in female, and 1.13 in male. Thus, combination of hyperuricemia and stroke revealed higher risk for female data. Concerning hyperuricemia, he was controlled at a satisfactory level by the administration of febuxostat [16]. He has maintained a stable level of uric acid for years, and unremarkable problems have been detected, such as the onset of gout, renal stones, or impaired renal function.

In this report, we have calculated the CV values from blood chemistry for years in Table 1. As a result, some biochemical items showed lower CV than expected. In particular, low degree of CV was found in RBC, Hb, HbA1c, Platelet, Cr, and HDL. The reason would be involved in the continuation of regular lifestyle, since the case has constant daily rhythm of meal, exercise and sleep, without alcohol or smoking. Such fact can be applied to the sports situation. World Anti-Doping Agency (WADA) has prohibited blood doping by conducting autologous blood transfusions (ABT) for increasing oxygen delivery [17]. For its analysis, Coefficient of Variation (CV) can become the most useful factor for detecting ABT. CV values will become hopefully some reference data in a variety of research.

Current case has continued super-LCD for years. As actual LCD continuation, three levels of LCD have been recommended to understand and perform easily. They would be super-LCD, standard-LCD, and petite-LCD, which have carbohydrate involvement ratios as 12%, 26%, and 40%, respectively [10,18]. These three methods roughly correspond to the situation that eating rice or bread would be 0, 1, 2, or 3 times per day. Super-

LCD almost equals 0 times of taking carbohydrate matter in 3 meals.

Some limitation may be present for this report. Current elderly man has less arteriosclerosis and stable glucose variability. It is because his long lifestyle has been almost perfectly stable with psychologically ideal heart and mind for himself and many people around him. We cannot know all his background for bio-psycho-social aspects so far, but will follow him up with careful attention for his clinical progress.

Conflict of Interest

The authors have read and approved the final version of the manuscript. The authors have no conflicts of interest to declare.

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