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Case Report

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A Diabetic Male with Metabolic Syndrome (Met-S) Treated by Low Carbohydrate Diet (LCD) and Oral Semaglutide

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Abstract

The patient was a 51-year-old male with metabolic syndrome (Met-S). Actually, he showed several problems of obesity as BMI 35.0 kg/m^2, type 2 diabetes (T2D), fatty liver, chronic kidney disease (CKD), hyperuricemia, and dyslipidemia. Positive biochemistry data included AST 126 U/L, ALT 143 U/L, UA 8.2 mg/dL, Cre 1.02 mg/dL, LDL 129 mg/dL, and HbA1c 6.3%, with a normal range of pulse wave velocity (PWV). He was treated by a low-carbohydrate diet (LCD) as diet therapy, continuing weight control by LCD, oral hypoglycemic agents (OHAs), and oral semaglutide (Rybelsus) as GLP-1RA. Then, his weight decreased 5 kg, and his general status has remained stable for 7 years.

Keywords

Metabolic Syndrome, Low Carbohydrate Diet, Oral Semaglutide, Rybelsus, Pulse Wave Velocity, Type 2 Diabetes

Abbreviations

Met-S: Metabolic Syndrome**;** LCD: Low Carbohydrate Diet; PWV: Pulse Wave Velocity; T2D: Type 2 Diabetes

Introduction

For decades, metabolic syndrome (Met-S) has been crucial for clinical management in various patients. Some related investigations have been observed from the National Health and Nutrition Examination Survey (NHANES) [1]. Among them, the prevalence of type 2 diabetes (T2D) has been the crucial problem of acute increase across the world in developing and developed countries [2]. T2D may aggravate clinically atherosclerotic cardiovascular disease (ASCVD) [3]. They include cerebral vascular accident (CVA), ischemic heart disease (IHD), and peripheral artery disease (PAD) [4].

Furthermore, the clinical relationship of T2D and obesity has been known [5]. For the prevalence ratio of obesity, overweight, and T2D, it would be more than one-third nowadays [6]. The number of diabetes mellitus (DM) seems to be elevated from 537 million to 783 million from 2021 to 2045 [7]. In these cases, several problems of ASCVD will be developed in the future. The main purpose of diabetic treatment would

be the prevention of ASCVD development [4].

Authors et al. have continued medical practice and research for various cases with ASCVD [8]. During our treatment, some kinds of low-carbohydrate diet (LCD) were applied for each situation according to the patient and diseased states [9,10]. They include petite-LCD, standard-LCD, and super-LCD, in which carbohydrate ratio shows 40%, 26%, and 12%, respectively [11]. Practical application of LCD has been more prevalent in various regions [12].

We have treated a variety of patients with Met-S and ASCVD for years and reported various backgrounds of patients. Recently, we happened to treat an impressive middle-aged male with obesity and T2D. He was evaluated and treated by LCD and oral hypoglycemic agents (OHAs). In this article, his generalized clinical progress and some related perspectives are described.

Case Presentation

History and Physicals:

The current case was a 51-year-old male who did not have any special diseases in his 30s. During his 40s, his weight had increased and he gradually became obese. He visited our clinic in 2018 for further evaluation of Met-S. For his physical examination, he showed unremarkable findings of speech, conversation, consciousness, head, chest, abdomen, and neurological exams. His stature was 173.5 cm in height, 105.4 kg in weight, and 35.0 kg/m^2 in body mass index (BMI).

Several Exams and Diagnoses:

Blood chemistry showed several abnormal results, which are summarized in **Table-1**. They included elevated liver function tests, decreased renal function to some degree, dyslipidemia, and elevated HbA1c value. Chest X-P and electrocardiogram (ECG) revealed unremarkable results. He underwent the pulse wave velocity (PWV) exam (**Fig-1**). As a result, Cardio-Ankle Vascular Index (CAVI) showed 6.9 and 7.3 (right/left), which were in the normal range as less than 8.9 and 7.9 ± 0.7. The value of ankle-brachial index (ABI) was 1.17 and 1.24 (R/L) as the normal range of 0.91–1.40. He underwent an abdominal CT scan for further evaluation of Met-S (**Fig-2**). The findings showed strong fatty liver in the liver. Furthermore, fatty infiltration was detected in the parenchyma of the pancreas. A diverticulum was found in the right colon.

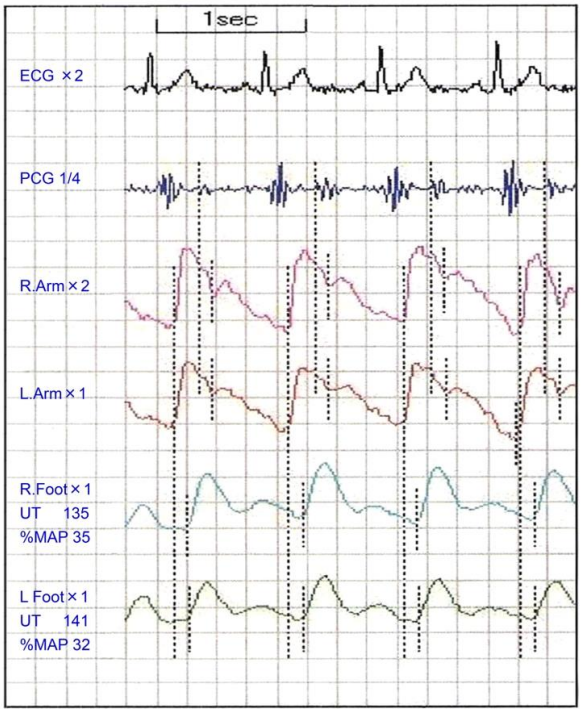

Fig-1: Results of PWV

ABI and CAVI values showed normal range.

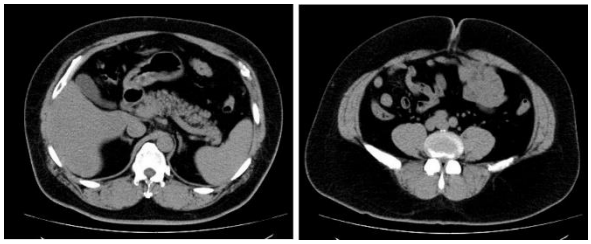

Fig-2: Findings of abdominal CT scan

A. Fatty liver with unremarkable GB and pancreas

B. Visceral fat and subcutaneous fat are noted

Medical Problems and Clinical Progress:

The case showed several medical problems. They are #1 obesity, #2 type 2 diabetes (T2D), #3 fatty liver, #4 chronic kidney disease (CKD), #5 hyperuricemia, #6 dyslipidemia. From these problems, our team recommended him to start a low-carbohydrate diet (LCD) for reducing weight. Furthermore, he continued several oral medicines, including amlodipine 5 mg, valsartan 80 mg, febuxostat 40 mg, imeglimin (Twymeeg) 2000 mg, and semaglutide (oral hypoglycemic agent as Rybelsus) 3 mg. He continued his treatment with diet therapy, exercise habits, and taking

several oral medicines for years. His body weight was reduced by 5 kg, and HbA1c value remained around the borderline. Liver function tests showed rather higher values. For renal function, creatinine and eGFR persisted at almost the same levels (**Table-1**).

Ethical Standards

This case complied with the guideline of the Declaration of Helsinki [13]. The principle showed ethical regulations for medical research. This guideline is from the Ministry of Health, Labor and Welfare and the Ministry of Education, Culture, Sports, Science, and Technology. Authors et al. established an ethical committee, including a director, doctors, nurse, dietitian, pharmacist, and legal professional. We discussed the protocol sufficiently and agreed. Informed consent was obtained from the patient.

Discussion

In this article, a middle-aged male showed several medical problems related to Met-S. They include #1 obesity, #2 T2D, #3 fatty liver, #4 CKD, #5 hyperuricemia, and #6 dyslipidemia. Furthermore, some factors were added for treatment, which are #7 LCD as diet therapy, #8 weight control, #9 oral hypoglycemic agents (OHAs), and #10 oral semaglutide as GLP-1RA. From the above, close relationships have been observed. They are i) Met-S includes #1, #2, #3, and #6, ii) #4 may be from #6 and possibly #2 (light degree), iii) #8 can be obtained from #7, #9, and #10 in particular, and these factors can be suggested to have mutual relationships.

In this case, persisting obesity probably contributed to the onset of T2D at middle age. A mutual association has been reported between weight status and T2D risk [14]. Elevated weight of more than 5% may increase T2D risk by >60%. In contrast, weight reduction of more than 5% can lower the T2D risk by >40%. For detailed data, odds ratios (OR) were 1.58, 1.76, and 1.70 by statistical analysis for the periods of 3-, 6-, and 9-year follow-up, respectively. Similarly, weight reduction of 5% contributed OR of 0.48, 0.57, and 0.51 for each 3 follow-up period.

Table-1: Progress of Biochemistry Data

	Units	2018		2019	2020	2023		2024	
		Apr	Oct	Jun	Aug	Jan	July	Jan	Nov
Liver									
AST	(U/L)	59	126	47	109	65	51	73	58
ALT	(U/L)	78	143	63	120	92	59	89	56
GGT	(U/L)	68	101	92	179	168	129	171	180
ALP	(U/L)	268	269	280	297	111	96	106	102
Renal									
UA	(mg/dL)	7.4	8.2	8.3	7.1	4.7	6.0	4.0	5.5
BUN	(mg/dL)	14	14	13	12		10		
eGFR	(mL/min/1.73m²)	66.1	63.3		59.9	59.8	60.1	60.8	61.1
Cre	(mg/dL)	0.98	1.02	0.91	1.06	1.05	1.04	1.03	1.02
Lipids									
HDL	(mg/dL)	59	52	51	44	50	44	53	49
LDL	(mg/dL)	125	129	102	130	113	113	122	110
TG	(mg/dL)	87	73	86	126	83	210	116	102
CBC									
WBC	(x10^2/μL)	52	55	70	58	75	66	65	62
RBC	(x10^4/μL)	520	524	530	535	535	557	584	567
Hb	(g/dL)	15.3	15.5	15.9	16.1	16.1	16.5	16.7	16.6
PLT	(x10^4/μL)	24.2	24.3	22.5	22.2		20.9		
Diabetes									
glucose	(mg/dL)		110			107	117	111	118
HbA1c	(%)		6.3	5.5	5.6	6.6	5.9	6.1	6.3

This case continued LCD as diet therapy and oral semaglutide as GLP-1RA for years. Actually, the degree of weight reduction was not so remarkable, which was probably due to incomplete limitation of LCD, less daily exercise, and low doses of semaglutide. When super-LCD is applied to patients with obesity, they usually show large weight reduction within a relatively short period [15]. Our clinical group previously reported LCD in a large cohort (n=2773), in which significant weight reduction of more than 10% was found in 24.0% of them [16]. When combining several beneficial points of diet therapy, LCD plus Mediterranean Diet (MD) will possibly become one recommended method suitable for Met-S, ASCVD, or anti-aging medicine [17].

Certain limitations may be present in this article. The current case showed T2D, obesity, and Met-S, and several factors showed mutual relationships. As for his HbA1c value, it was rather stable, but totally satisfactory management and progress would be expected. His future clinical course will be carefully followed up.

In summary, a 51-year-old man with several medical problems was reported, associated with some perspectives. Such a case has to be managed properly with weight reduction and other adequate medical treatment. It is expected that this case report will become a useful reference for diabetic and cardiovascular problems.

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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