Letter

Diabetes Metab J 2022;46:512-514
https://doi.org/10.4093/dmj.2022.0134
pISSN 2233-6079 · eISSN 2233-6087

dmj
DIABETES & METABOLISM JOURNAL

Association between Metabolic Syndrome and Microvascular Complications in Chinese Adults with Type 1 Diabetes Mellitus (*Diabetes Metab J* 2022;46:93-103)

Gyuri Kim

Department of Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

Metabolic syndrome is a cluster of metabolic abnormalities including central obesity, impaired glucose tolerance, dyslipidemia, and hypertension [1]. Numerous previous studies have highlighted its importance due to the associated risk with type 2 diabetes mellitus, cardiovascular disease, and mortality, in relation to insulin resistance. The prevalence and incidence of metabolic syndrome have increased worldwide and it may have a significant impact on public health. Although several studies revealed that metabolic syndrome in patients with type 1 diabetes mellitus (T1DM) is also common and increased in Western populations, the prevalence of metabolic syndrome and its relationship with diabetes-related complications in patients with T1DM in Asian countries are not well established.

In this article, entitled "Association between metabolic syndrome and microvascular complications in Chinese adults with type 1 diabetes mellitus," Huang et al. [2] explored the prevalence of metabolic syndrome among adult patients with T1DM in China and evaluated its association with risk factors and microvascular complications. The prevalence of metabolic syndrome in the study population was 15.1%. Huang et al. [2] showed that female sex (odds ratio [OR], 2.86; 95% confidence interval [CI], 1.63 to 5.02; $P=0.047$), longer diabetes duration (OR, 1.04; 95% CI, 1.00 to 1.08; $P<0.001$), higher body mass index (OR, 1.14; 95% CI, 1.03 to 1.25; $P=0.009$), glycosylated hemoglobin (HbA1c) (OR, 1.23; 95% CI, 1.11 to 1.36; $P<0.001$), and nutrition therapy (OR, 0.46; 95% CI, 0.26 to 0.78; $P=0.005$) were significantly associated with the prevalence of metabolic syndrome in patients with T1DM. After adjusting for sex, age, diabetes duration, HbA1c, and other lifestyle and socioeconomic factors, metabolic syndrome was independently associated with the presence of diabetic kidney disease (DKD) (OR, 2.14; 95% CI, 1.12 to 4.11; $P=0.022$) and diabetic retinopathy (DR) (OR, 3.72; 95% CI, 1.59 to 8.72; $P=0.002$). These findings are consistent with previous reports that have shown an association between metabolic syndrome and albuminuria, DKD, and DR in patients with T1DM [3]. However, there are several issues to be discussed.

First, as noted by the authors, insulin dose and medications for hypertension and dyslipidemia are important variables to define and characterize patients with metabolic syndrome and T1DM, but these data were missing from the study. Intensive insulin therapy at high dosages can cause weight gain and increased insulin dose can be a clinical indicator of insulin resistance [4]. There was a relationship between intensive insulin treatment and a higher subsequent prevalence of metabolic syndrome [5]. In addition, the presence of insulin resistance in patients with T1DM may lead to quantitative lipid abnormalities. However, although most patients with T1DM showed ab-

Corresponding author: Gyuri Kim https://orcid.org/0000-0002-2242-2816
Division of Endocrinology and Metabolism, Department of Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, 81 Irwon-ro, Gangnam-gu, Seoul 06351, Korea
E-mail: gyuri5.kim@samsung.com

normal lipid levels and atherogenic changes in lipoprotein composition, T1DM patients with optimal HbA1c had similar or even lower atherogenic lipid profiles due to peripheral hyperinsulinemia than nondiabetic controls, showing that glycemic control is an important mediator of lipid abnormalities [6]. Also, HbA1c was independently correlated with total cholesterol, low-density lipoprotein cholesterol (LDL-C), and non-high-density lipoprotein cholesterol levels, indicating that abnormalities in lipid profiles were mostly observed in T1DM patients with poor glycemic control [7]. In the study by Huang et al. [2], the mean HbA1c was 9.2% in subjects with metabolic syndrome, indicating that glycemic control was not optimized. More than half of the study population was treated with therapies other than insulin pump or basal-bolus insulin therapy, which may be inadequate to achieve intensive insulin therapy. Therefore, although there was a significant association between metabolic syndrome and DKD or DR in patients with T1DM after adjustment for HbA1c, further adjustment for body mass index or subgroup analyses based on categories of optimal and poor or suboptimal glycemic control could provide more information. Moreover, specific medications for hypertension such as angiotensin-converting enzyme inhibitors and angiotensin receptor blockers, and sodium glucose co-transporter 2 inhibitors have shown beneficial effects on renal outcomes, including albuminuria [8,9]. Also, adjunctive metformin use in T1DM may confer additional benefits on diabetes management, leading to enhanced insulin sensitivity and reduced total daily insulin dose, body weight, triglycerides, and LDL-C; thus, metformin could be considered in T1DM patients with metabolic syndrome [10]. Therefore, information about the use of these medications in the current study population would be helpful.

In addition, the results of this study raised important issues that need to be taken into account with regard to the management of T1DM. The ORs of those who received diabetes education and those who followed a diabetic diet were not significantly different between those with and without metabolic syndrome, but T1DM patients who received nutrient therapy education exhibited a reduced OR for metabolic syndrome. Also, the study highlighted the presence of metabolic syndrome in patients with T1DM to identify the risk of microvascular complications. Therefore, more intensive diabetes education programs on insulin therapy and therapeutic strategies such as physical exercise, weight control, and healthy diet are essential for T1DM patients with metabolic syndrome to improve metabolic syndrome status and ultimately reduce diabetes-related complications.

Lastly, this was a cross-sectional study, and further longitudinal studies regarding changes in metabolic syndrome status from the time of diagnosis of T1DM and the incidence of diabetes-related microvascular and macrovascular complications are warranted.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

ORCID

Gyuri Kim *https://orcid.org/0000-0002-2242-2816*

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