

Sleep Disorder and Cardiovascular Risk Factors in Type 2 Diabetes Mellitus

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Disturbed sleep was recently proposed as a novel risk factor for type 2 diabetes mellitus (T2DM). Experimental restriction of sleep to 4 hours per night for 6 nights resulted in impaired glucose tolerance in healthy young adults [1]. Because diabetes carries a high risk of cardiovascular mortality, the impact of sleep restriction on glucose regulation suggests a mechanism linking short sleep time and increased mortality.

The term sleep-disordered breathing (SDB) encompasses a range of breathing abnormalities that occur during sleep. These include obstructive sleep apnea (OSA), central sleep apnea, and periodic breathing. SDB may be more common in people with T2DM. Some risk factors for diabetes, including obesity, visceral adiposity, and advancing age are also associated with SDB. Evidence from a growing body of research suggests that SDB is associated with adverse cardiovascular disease (CVD) risk factors and outcomes including hypertension and myocardial infarction. Similarly, CVD risk is substantially elevated among people with diabetes. Since diabetes and SDB not only share important risk factors, but may also be associated with CVD, the two conditions may be related to one another [2-5].

Recent research has demonstrated the likelihood of a

relationship between T2DM and OSA, the most common form of SDB. The International Diabetes Federation (IDF) [6] consensus statement on sleep apnea and T2DM raises awareness of the association between the two conditions, which has significant implications on public health and on the lives of individuals.

According to the IDF, estimates suggest that up to 40% of people with OSA have diabetes [3,6], but the incidence of new cases of diabetes in people with OSA is not known. In people who have diabetes, the prevalence of OSA may be up to 23%, and the prevalence of some form of SDB may be as high as 58%. Overweight and obesity may play a role, but some recent studies have shown that the association between SDB and diabetes is independent of overweight/obesity. OSA may affect glycemic control in people with T2DM, and it is associated with a range of cardiovascular complications such as hypertension, stroke, and heart failure.

Although early studies indicated a possible causal association between the presence of OSA and the development of T2DM, several of these studies had significant limitations including small sample size, highly selected population, inadequate adjustment for confounders, and use of surrogate measures such as snoring to assess OSA. The Wisconsin Sleep Cohort Study showed a significant cross-sectional association between OSA and T2DM for all degrees of OSA, which was preserved in participants with

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moderate to severe OSA after adjustment for obesity (odds ratio, 2.3) [7]. However, the longitudinal data from the same study showed that after adjusting for obesity, OSA at baseline was not a significant predictor for the development of diabetes over 4 years.

In this issue, Shim et al. [8] reported that sleep disorder (SD) was prevalent in Korean patients with T2DM and that OSA could aggravate the risk of cardiovascular disease. They enrolled 784 patients with T2DM and measured sleep quality using the self-administered Pittsburgh Sleep Quality Index and determined the risk of OSA using the Berlin Questionnaire. The findings from this study are important because few studies have investigated the association between sleep quality and the risk of OSA, particularly in Asians. Among the patients, 38.4% had poor sleep quality and 15.8% were at high risk for OSA. The frequency of risk for OSA was higher in patients who were obese compared to nonobese patients, and the logistic regression analysis revealed male gender and body mass index as independent predictors of risk for OSA.

OSA is common in patients with T2DM, and identifying the mechanisms that underlie this condition and determining the effective treatment options are important. Laboratory studies in healthy subjects have shown that low cerebral glucose utilization, elevated sympathetic activity, high evening cortisol levels, alterations in growth hormone release, and elevated markers of inflammation mediate the adverse effects of reduced sleep duration and quality on glucose metabolism.

Several strategies for the management of SD and cardiovascular risk factors in T2DM exist. First, weight loss has been shown to be associated with improvements in the apnea-hypopnea index. Thus, weight loss is a primary treatment strategy for OSA in patient who are overweight or obese. Second, many studies have investigated whether treatment of OSA with continuous positive airway pressure (CPAP) improves glucose metabolism and glycemic control. The results, however, of studies on OSA treatment in patients with T2DM have been equivocal. Harsch et al. [9] reported that CPAP produced a significant improvement in insulin sensitivity after 3 months, but had no effect on HbA1c. Milleron et al. [10] and Marin et al. [11] reported that treatment of OSA with CPAP affected a range of cardiovascular measures, and Mansfield et al. [12] showed that CPAP treatment reduced ventricular ectopy and improved cardiovascular outcomes in patients with

heart failure. However, the argument that CPAP treatment significantly reduces insulin resistance and HbA1c still persists.

This editorial has addressed the complex relationship between SD and T2DM and discussed the various mechanisms linking these two conditions. Despite the availability of diagnostic measures and effective treatment, many patients with SDB remain undiagnosed. Thus, SD continues to be a significant health risk for affected individuals and the general public. Awareness and timely initiation of an effective treatment may prevent potential deleterious cardiovascular effects of SD in patients with T2DM.

Conflict of interest

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

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