Effect of Sleep Disturbances on Quality of Life, Diabetes Self-Care Behavior, and Patient-Reported Outcomes

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IN BRIEF Poor sleep quality and sleep disorders, particularly insomnia, obstructive sleep apnea, and restless legs syndrome, are prevalent among people with type 2 diabetes. Evidence suggests that coexisting diabetes and sleep disturbances are associated with decreases in quality of life, diabetes self-care behaviors, and patient-reported outcomes. Additional research is required to determine the effect of treatment of sleep disorders on patient-centered outcomes in people with type 2 diabetes.

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According to the American Diabetes Association, there are an estimated 29.1 million people with diabetes in the United States, and 90–95% of them have type 2 diabetes (1). Recent studies suggest that poor sleep quality and sleep disorders, including insomnia, obstructive sleep apnea (OSA), and restless legs syndrome (RLS), are extremely prevalent in people with diabetes (2–10). Diabetes is a chronic disease that frequently results in increased self-care burden and complications that are associated with decreased quality of life (11). Previous studies have described the negative effect of impaired sleep on aspects of quality of life, self-care behavior, and patient-related outcomes in the general population. However, the effect of impaired sleep in people with type 2 diabetes remains less well elucidated. The purpose of this article is to briefly describe common sleep disorders in people with diabetes and then to discuss studies that have examined the effect of sleep disturbances on quality of life, diabetes self-care behaviors, and patient-reported outcomes in adults with type 2 diabetes.

Common Sleep Disorders

Poor sleep quality and sleep disorders—particularly insomnia, OSA, and RLS—are common problems in people with type 2 diabetes (3,6,8,12,13). Sleep quality provides a global subjective assessment of sleep that includes features such as sleep duration, time needed to initiate sleep (i.e., sleep latency), percentage of time asleep while in bed (i.e., sleep efficacy), sleep disturbances, and general satisfaction with sleep (14). Studies utilizing the Pittsburgh Sleep Quality Index (PSQI) (14) indicate that people with type 2 diabetes have poor sleep quality (mean PSQI global scores 6.3–8.3), with 49–71% identified as poor sleepers according to the suggested cutoff for the PSQI global score (PSQI >5) (8,15–17). Data from self-reports and polysomnography suggest that people with type 2 diabetes have an average sleep duration of 6 hours (15,18).

Insomnia can be defined as a symptom comprising sleep-specific complaints such as difficulty initiating and maintaining sleep, waking too early, and difficulty returning to sleep, or as nonrestorative sleep, or as a disorder denoting sleep and day-

time symptoms, including fatigue, irritability, and decreased concentration. Insomnia may be transient, but it can become a chronic problem if perpetuated by maladaptive sleep habits and dysfunctional beliefs and attitudes about sleep. The prevalence of insomnia is significantly higher among people with type 2 diabetes than among those without type 2 diabetes, even after accounting for age and sex (12,19). With regard to specific insomnia symptoms, 8–17% of people with type 2 diabetes report difficulty falling asleep, 23–40% have difficulty staying asleep, and 26–43% report difficulty both in initiating and maintaining sleep (7,12).

RLS is a condition that negatively affects sleep and is prevalent in people with type 2 diabetes (13). RLS has a higher prevalence in people with type 2 diabetes than in the general population. Symptoms of RLS include an uncomfortable urge to move the legs or unpleasant sensations that worsen with rest or inactivity and increase in intensity during the evening and at night; movement brings partial or total relief of these negative sensations (20). Frequently, RLS symptoms result in a secondary insomnia, with disturbance of the individual's ability to initiate and maintain sleep.

OSA is a common sleep disorder characterized by recurrent occurrences of upper airway collapse during sleep that produces apneas (cessation of airflow for at least 10 seconds) and hypopneas (decreased airflow by 50% that is associated with an oxygen desaturation). There is a transient arousal from sleep that is associated with the termination of apneas and hypopneas. Sleep disruption due to frequent arousals may lead to excessive daytime sleepiness or fatigue. The most common signs of OSA are loud snoring, gasping, or witnessed pauses in breathing, as well as excessive daytime sleepiness. An apnea-hypopnea index (AHI), which is the mean number of apnea and hypopnea episodes per hour of sleep, is obtained during overnight polysomnography and used to diagnose OSA. The following thresholds are used to classify the severity of OSA: normal (AHI <5), mild (AHI 5–14.9), moderate (AHI 15–30), and severe (AHI ≥30). OSA often goes undiagnosed among people with type 2 diabetes, such that only 18% of those being managed in primary care clinics received an OSA diagnosis (5).

Overweight and obesity are not only risk factors for type 2 diabetes, but also major risk factors for OSA (4). The prevalence of moderate to severe OSA among people with type 2 diabetes is high, with rates ranging from 24 to 36% (6,8,9,21), and is significantly greater than in those without type 2 diabetes (5,9,21). Older age, male sex, and obesity are the strongest risk factors for OSA (3,6,10,22). In an epidemiological study of obese people with type 2 diabetes, 87% were found to have OSA, with 30.5% having moderate OSA and 23% having severe OSA (4).

Quality of Life

Quality of life, according to the World Health Organization (23), encompasses physical and psychological health, functional status, and beliefs, values, and relationships. Studies examining the association between sleep and quality of life have primarily examined aspects of health-related quality of life (HRQoL). A large study (n = 19,711; 5,161 with insomnia and 14,550 without insomnia) found that people with insomnia had significantly (P <0.01) lower physical HRQoL, mental HRQoL, and work productivity than people without insomnia (24). Sleep disorders such insomnia, RLS, and OSA and poor sleep quality have all been associated with decreased quality of life in people with diabetes (8,25–27).

A study of individuals with type 2 diabetes (n = 300) examined the relationship between sleep quality, HRQoL, and diabetes-related quality of life (8). People with poor sleep quality (PSQI >5) had significantly lower scores on HRQoL (SF-36 Mental Component Summary and subscores [social functioning, emotional role, and mental health] and SF-36 Physical Component Summary and subscores [physical functioning, physical role, bodily pain, general health, and vitality]) and on Diabetes Quality of Life (DQOL) questionnaire total score and subscores (DQOL satisfaction, DQOL impact, and DQOL diabetes-related worry; all P <0.002). Similar findings were found in another study of patients (n = 124) with comorbid RLS and type 2 diabetes; RLS was an independent risk factor for lower scores on the SF-36 Mental Component Summary score and the vitality, mental health, and role limitations subscores related to emotional health problems (28).

Diabetes Self-Care Behavior

Although the association between decreased quality of life and sleep disturbances is well established, the effect of impaired sleep on aspects of diabetes self-care behaviors (e.g., physical activity, diet choices, and medication adherence) is less certain. In a descriptive correlational study of 107 adults with type 2 diabetes (29), increased subjective daytime sleepiness (Epworth Sleepiness Scale) (30) was significantly associated with worse self-care and control problems. Additionally, impaired sleep quality (PSQI) (14) was significantly associated with lower scores on diabetes glycemic control, a worse attitude toward activities required for optimal management of diabetes, decreased positive attitude toward feeling able to manage diabetes, lower self-reported adherence to good self-care behaviors, and decreased adherence to good diet choices (all P <0.05).

Maintaining a physically active lifestyle is important in the prevention of diabetes. Preliminary evidence suggests that impaired sleep has a negative impact on physical activity in people with diabetes. Data from the 2005–2006 National Health and Nutrition Examination Survey found that impaired sleep was com-

mon (26% with ≤6 hours of sleep per night; 17% with daytime sleepiness) among people with prediabetes (n = 866) (31). A regression analysis found higher levels of insomnia symptoms to be a significant predicator of objectively measured steps after controlling for age, BMI, self-reported health, and education (P = 0.026). Results from several studies indicate that inadequate sleep, poor sleep quality, and sleep disorders such as OSA are associated with decreased objective physical activity and subjective vigor in people with diabetes (32–35). Furthermore, data from a small intervention study (n = 23) suggest that treatment of OSA without assistance in improving activity in people with type 2 diabetes who have a sedentary lifestyle may be insufficient to change established behaviors (35).

Adherence to prescribed diabetes medications is essential for glycemic control. There is a lack of information on the effect of impaired sleep on medication adherence in people with diabetes. However, data from an observational study of older adults (n = 897, 37% [n = 338] with diabetes) found that self-reported medication nonadherence according to the 4-item Morisky Medication Adherence Scale (36) was increased by almost 50% in individuals with sleep disturbances (odds ratio [OR] 1.48, 95% CI 1.12–1.96) (37). These results agree with a prospective study on the effect of impaired sleep on medication nonadherence; among heart failure patients (n = 280), those with impaired sleep quality were significantly more likely to be nonadherent to their medication regimen (P = 0.035) (38).

Patient-Reported Outcomes

In addition to impeding diabetes self-management, sleep disturbances have also been found to negatively affect psychological well-being and daily functioning. In a sample of 39 adults with type 2 diabetes with and without RLS, decreased sleep quality was associated with more fatigue and depression symptoms, and these associations persisted when adjusting for RLS status (13). Data from another study of people with type 2 diabetes found that those with RLS had more than three times the depression risk (OR 3.21, 95% CI 1.07–11.23) of those without RLS (28). Sleep quality has been found to have an indirect effect on the relationship between psychological distress (depression and anxiety symptoms) and diabetes-related quality of life (39).

Data from a recent study (26) suggest that poor sleep quality in adults with type 2 diabetes is associated with decreased functional outcomes evaluated by the Functional Outcomes of Sleep Questionnaire (FOSQ), including the capacity to realize a lifestyle that is active and productive, maintain social relationships with friends and family, sustain vigilance to required tasks, and continue healthy intimate sexual relationships, even after controlling for age, race, BMI, marital status, and HRQoL.

Poor sleep quality, insomnia symptoms, OSA, and sleep disturbances such as pain, RLS symptoms, and nocturia are associated with increased odds of frequent daytime sleepiness among adults with type 2 diabetes. Those with untreated OSA may experience daytime sleepiness resulting from fragmented sleep due to arousals associated with termination of apneas and hypopneas. Compared to age- and sex-matched controls without type 2 diabetes, excessive daytime sleepiness, defined as an Epworth Sleepiness Scale score ≥12, was significantly more frequent among those with type 2 diabetes (2.1 vs. 15.5%, P = 0.02) (12). In a sample of 44 male veterans with type 2 diabetes, those with daytime sleepiness had significantly lower functional outcomes based on the FOSQ total score and all FOSQ subscale scores (40). These associations remained significant after controlling for sleep duration. Data from studies of normoglycemic patients with OSA found that functional outcomes (FOSQ scores) (41) are improved with continuous positive air pressure (CPAP) treatment if patients wear their CPAP devices for ≥6 hours per night (42,43). Furthermore, daytime sleepiness was associated with significantly higher levels of stress and physical and mental exhaustion (40). A secondary analysis of data from the 2003 Sleep in America poll found that adults with type 2 diabetes and daytime sleepiness had lower self-rated health and greater physical functioning impairment and were more likely to take daytime naps and feel that they accomplish little during the day compared to those without daytime sleepiness (44).

Conclusion

Impaired sleep quality and sleep disorders are prevalent in people with type 2 diabetes. Preliminary data suggest that poor sleep is associated with increased fatigue and daytime sleepiness, decreased quality of life, impaired self-management, increased mood disturbances, and decrements in functional outcomes in areas sensitive to sleep disruption. There is a lack of evidence regarding the potential effects of treating sleep disorders on patient-centered outcomes, suggesting that further research is necessary to evaluate whether sleep disorder treatment could be an effective strategy for addressing this potential barrier to effective diabetes management.

Duality of Interest

No potential conflicts of interest relevant to this article were reported.

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