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Perspective

Chronotherapy in Treatment of Diabetes Mellitus

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DESCRIPTION

Chronopharmacology is the study of how the effects of drugs vary with biological timing and endogenous periodicities. The main aim is to predict the changes in both desired effects and tolerance of medications.

Chronotherapy should be non-toxic within approved limits of use. It should have a specific triggering biomarker for a given disease state. It should have a feedback control system. Especially in case of parenteral administration, it should be biocompatible and biodegradable. It should be easy to administer into patients in order to enhance compliance to dosage regimen.

It is drug free and more effective when a person sleeps for several hours. But the disadvantage of chronotherapy is it develops a non 24 hours sleep wake syndrome after the treatment as the person sleeps during the treatment. The person becomes less productive during chronotherapy and it is time taking so the person have to take time off from the busy normal schedule. The patient needs to consult the doctor regularly to avoid side effects. The person may feel hot or cold sometimes.

The challenges of modern life can be managed to be in better alignment with our circadian rhythm. In order to have less effect on blood glucose, a high carbohydrate meal can be taken during day time rather than night time. Light therapy and melatonin supplementation can be used to align the circadian rhythm with the rhythm of their life and eating habits. The blood glucose levels and many diseases associated with uncontrolled blood glucose are linked to the internal clocks. Modern people will certainly benefit from knowing how they can make simple lifestyle changes to improve their overall health.

The glucose homeostasis is one of the most fundamental physiological processes in mammals that are driven by the timing system as it is heavily dependent on the predictive capacity of the system to coordinate metabolic function with daily variation in nutrition uptake. The studies conducted on humans and rodents have confirmed that the daily rhythms of blood glucose and insulin secretion are regulated by the timing system. The molecular clock is essential for glucose metabolism, as evidenced by the impairment of glucose tolerance and insulin sensitivity upon disruption of core clock gene expression. Though SCN-driven neuroendocrine and autonomic outflow influence glucose homeostasis, peripheral clocks in the liver and pancreas also play a role in glucose management.

The most salient rhythm regulated by the internal timing system in mammals is the sleep/wake cycle. For some time it has been appreciated that those suffering from metabolic disease, including obesity, impaired glucose tolerance or diabetes also display comorbid sleep difficulties. Most common among these conditions is sleep-disordered breathing, including obstructive sleep apnoea. Insufficient sleep and/or poor sleep quality are potent risk factors for obesity and cardio metabolic disease. A large proportion of patients with insomnia (over 50%) present with comorbidities including cardiovascular disease, mental illness, obesity and diabetes. Conversely, patients with type 2 diabetes often report higher rates of insomnia, with studies indicating that roughly 50% of adult diabetic individuals have insomnia compared with roughly 30% of individuals without diabetes. Other sleep disorders, such as reduced sleep times/insufficient sleep, have been reported among individuals with type 2 diabetes. Recently it was reported that sleep duration is a strong predictor of cardio metabolic risk score in obese adolescents. A large nurses' health study found that individuals who slept less than 5 h per night had a greater risk of being diagnosed with symptomatic diabetes. If indeed short or fragmented sleep is an independent risk factor for obesity and poor glycaemic control, there is potential for improved sleep quality to ameliorate these outcomes. The reverse may also be true; treating glucose intolerance may improve sleep. In fact, data show that the insulin-sensitizing drug metformin is associated with improved sleep efficiency in individuals with type 2 diabetes.

It is clear that melatonin secretion is associated with insulin resistance in diabetic individuals and that a decline in circulating melatonin could underlie both an increased risk of type 2 diabetes and comorbid sleep disturbances.

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