CHAPTER 21

Next-Day Residual Effects of Sleeping Medications on Driving Ability:
A Review of the Literature

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Abstract

Poor sleep quality often results in decreased alertness, drowsiness and sleepiness the following day. Pharmacological treatment of sleep complaints can aggravate these effects, resulting in impaired performance at work and during daily activities such as driving a car. The first hypnotics, the barbiturates, have a limited safety profile and produce significant daytime impairment. They were replaced by the benzodiazepines during the 1970s, which showed to be efficient in the treatment of insomnia but are much safer than the barbiturates. However, bedtime use of benzodiazepines also produces sleepiness and significantly impairs driving performance the following day. The presence and severity of driving impairment varies between benzodiazepines, depending on their half-life, dosage and time after administration. Nonbenzodiazepines such as zopiclone, zolpidem and zaleplon were developed to overcome the residual hypnotic effects interfering with daytime performance. Zolpidem showed little to no daytime driving impairment when administered at bedtime, but middle-of-the-night administration is not recommended for this drug. In contrast, zaleplon (10 mg and 20 mg), administered either at bedtime or in the middle of the night, does not affect driving ability. Therefore, zaleplon is a safe alternative for patients suffering from insomnia that want treatment as needed (during the night when symptoms occur), and are willing to drive a car the following morning.

Introduction

Main complaints of patients suffering from insomnia include sleep initiation problems, and nocturnal or early-morning awakenings, all resulting in poor sleep quality. Sleep disorders not only affect nighttime sleep, but they also interfere with daytime functioning. Approximately 35% of the population experiences sleep problems, and 17% of these patients reported that insomnia affects their daily living negatively. Thus, sleep disturbances are commonly reported and must be viewed as a health problem with a great impact on society. Sleep disturbances can be categorized according to their duration as transient insomnia (<1 week), short-term insomnia (1-3 weeks) or chronic insomnia (months). Further, insomnia can be a primary disorder, or sleep disturbances can occur secondary to another medical condition or psychiatric disease, such as depression, anxiety or panic disorder.

Ideally, treatment of insomnia will produce adequate relief of sleep disturbances, without residual hangover effects the day following treatment. That is, patients should feel refreshed after a hypnotic-induced sleep. In reality, hangover effects often accompany the use of hypnotics. Hangover effects include daytime fatigue, concentration problems, impaired memory functioning and psychomotor effects that can compromise the performance of daily activities such as driving a car.

Since barbiturates were abandoned from practice due to their narrow therapeutic span and unfavorable adverse effect profile, benzodiazepines became the first-choice treatment for those suffering from insomnia. Drugs from the benzodiazepine family showed to be therapeutically effective, but next day hangover effects often accompany their use. In addition, abuse potential, withdrawal and rebound effects limit the clinical use of benzodiazepines. Nonbenzodiazepine drugs such as zopiclone, zolpidem and zaleplon were developed to overcome these effects. This review will focus on the residual effects of hypnotics on driving, one of the most common daily activities.

Although residual effects of hypnotics are sometimes preferred in hospitalized patients (e.g., after surgery), most patients suffering from insomnia are ambulatory patients and presumably continue their daily activities including driving a car. Driving a car is part of almost everyone's life, promoting personal freedom and independence, and thus an important determinant of our quality of life. On the other hand, participating in traffic also includes the risk of becoming involved in traffic accidents. Traffic accidents occur on a daily basis and are accepted as a possible risk that's taken while driving. However, some drivers such as the elderly and young novice drivers have increased traffic accident risks. Other high-risk groups include those driving under the influence of alcohol and psychoactive drugs.

The implication of pharmacological treatment of sleep disorders for driving performance becomes evident from epidemiological data. A classic epidemiological study performed by Borkenstein and colleagues established a relationship between increased traffic accident risk and the use of alcohol. That is, with increasing blood alcohol concentration (BAC) the risk of being involved in traffic accidents increases exponentially. Various studies replicated their finding and more recent research concentrated on the relationship between medicinal drugs and traffic accident risks. A relationship has also been reported between traffic...
The on-the-road driving test was developed in the nineteen eighty­
one or 95 km/h) and steady lateral position within the right
lane. As illustrated by Figure 2, SDLP can thus be regarded as an
index of driving safety.

Performance worsens gradually. Performance decrement in tests re­
quiring sustained attention has been reported for many benzodi­
azepines and is caused by the monotonous vigilance character
of the road. This is illustrated in Figure 1.

Primary parameter measuring vehicle control in the driving test is the Standard Deviation of Lateral Position (SDLP), i.e.,
the amount of weaving of the car. In placebo conditions, SDLP
of experienced drivers (driving at least 5000 km/year) generally
ranges between 18 and 22 cm. However, drug effects can pro­
duce SDLP increment to 35 cm or more. This excessive weaving
results in unsafe driving characterized by repeated excursions
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Figure 1. Illustration of the test vehicle. Note that the camera for lateral
camera, mounted on the roof of the car, continuously records
the actual position of the car within the traffic lane, by tracking
the relative distance of the car from delineated stripe in the middle
of the road. This is illustrated in Figure 1.

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Figure 2. Standard deviation of the lateral position, SDLP.