Alcohol interferes with the restorative functions of sleep

August 15 2011

Large amounts of alcohol are known to shorten sleep latency, increase slow-wave sleep, and suppress rapid eye movement (REM) during the first half of sleep. During the second half of sleep, REM increases and sleep becomes shallower. A study of the acute effects of alcohol on the relationship between sleep and heart rate variability (HRV) during sleep has found that alcohol interferes with the restorative functions of sleep.

Results will be published in the November 2011 issue of *Alcoholism: Clinical & Experimental Research* and are currently available at Early View.

Alcohol affects overall sleep architecture," said Yohei Sagawa, a medical doctor in the department of neuropsychiatry at the Akita University School of Medicine. "Normally, during physiologic nocturnal sleep in humans, the parasympathetic nervous system, responsible for 'rest-and-digest' activities, is dominant over the sympathetic nervous system, responsible for stimulating activities. We wanted to investigate how alcohol may change this complementary relationship."

"I believe that the approach used in this study is unique," added Seiji Nishino, director of the Sleep & Circadian Neurobiology Laboratory at Stanford University School of Medicine. "Although there are several studies monitoring HRV during sleep, as far as I know there is no report describing the effects of alcohol on autonomic nervous system during sleep using this parameter."

Sagawa and his colleagues gave 10 healthy, male university students with a mean age of 21.6 years three different alcohol beverages at three week intervals: 0g (control), 0.5g (low dose), or 1.0g (high dose) of pure ethanol/kg of body weight. On the day of the experiment, a Holter electrocardiogram was attached to the subject for a 24-hour period; the subject was instructed to drink one of the three alcoholic beverages 100 minutes before going to bed; and polysomnography was then performed for eight hours. Power spectral analysis of the HRV was performed using the maximum entropy method, and the low- and high-frequency components along with their ratios were calculated.

"Our study showed that alcohol suppresses the high-frequency power during sleep in a dosage-dependent manner," said Sagawa. "Although the first half of sleep after alcohol intake looks good on the EEG, the result of the assessment regarding the autonomic nerve system shows that drinking leads to insomnia rather than good sleep."

More specifically, as alcohol consumption increased, the heart rate increased and the spectral power of HRV measured at each frequency range decreased. Also, the low-frequency/high-frequency ratio that is considered an index of the balance between the sympathetic and parasympathetic systems was increased. This suggests that alcohol, in a dosage-dependent manner, suppresses the high-frequency component of HRV that is an indicator of parasympathetic nerve activity during sleep.

"The current study evaluates the acute effects after only a single dose of alcohol intake, and subsequently found a negative health consequence," observed Nishino. "Many subjects habitually drink alcohol, and if the reduction of parasympathetic nerve activity during sleep chronically occurred, negative health consequences may be much larger and may induce various diseases. It is reported that habitual drinkers with hypertension are often associated with reductions of parasympathetic nerve activities."

Sagawa agreed. "Many alcoholics and habitual drinkers suffer from insomnia," he said. "Suppressed parasympathetic nerve activity is the result of alcohol drinking. Thus, it is inferred that suppressed parasympathetic nerve activity is associated with insomnia, which includes difficulty getting to sleep, early-morning awakening, lack of a sense of deep sleep, and difficulty maintaining sleep."

"It is generally believed that having a nightcap may aid sleep, especially sleep initiation," said Nishino. "This may be true for some people who have small amounts of alcohol intake. However, it should be noted that large amounts of alcohol intake interfere with sleep quality and the restorative role of sleep and these negative consequences may be much larger during chronic alcohol intake."

Sagawa added that it is important for clinicians who are treating physical and psychological disorders related to alcohol to consider the disturbing effects on sleep's restorative effects that habitual drinking can have.

Provided by Alcoholism: Clinical & Experimental Research