Study shows different anesthetics affects sleep cycles in different ways

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(Medical Xpress) -- In the ongoing quest to find the exact way that anesthetics interact with the central nervous system, anesthesiology researchers have been examining whether the state induced by anesthetics resembles natural sleep. One way to measure this is to determine whether undergoing general anesthesia results in a sleep debt for patients. Previous research has shown that the injected anesthetic propofol does not cause a sleep deficit. Now, researchers at the Perelman School of Medicine at the University of Pennsylvania have shown in animal models that another group of anesthetics, commonly used in the operating room, do not substitute for natural sleep and may cause complications for surgery patients already at-risk for sleep-related issues. The new research is published in the October 2011 issue of the journal *Anesthesiology*.

"Recent studies have repeatedly found a similarity between the state induced by general anesthesia and the deepest stages of NREM sleep, yet we all realize that the states are not identical. Even the deepest sleeper can be awakened by environmental stimuli whereas the anesthetized patient does not reawaken until delivery of anesthetic drugs are terminated," said Max B. Kelz, MD, PhD, assistant professor of Anesthesiology and Critical Care and the study's lead author. "In contrast to previous research done with propofol, our study found that volatile inhaled anesthetics cause a REM sleep deficit, suggesting that this group of anesthetics do not fully substitute for natural sleep, which consists of both NREM and REM sleep."

Sleep is prompted by natural cycles of activity in the brain and consists of two basic states: rapid eye movement (REM) sleep and non-rapid eye movement (NREM) sleep. During sleep, the body cycles between non-REM and REM sleep. Typically, people begin the sleep cycle with a period of non-REM sleep followed by a very short period of REM sleep.

In the current study, researchers used electroencephalography and electromyography to assess NREM and REM sleep patterns in mice before and after a 6-hour exposure to the inhaled anesthetics isoflurane, sevoflurane, and halothane. They found that the mice in all three groups exhibited a significant doubling of REM sleep after the anesthetics had worn off, similar to the effects of significant natural sleep deprivation. Only one anesthetic agent, halothane, also caused an additional NREM sleep debt.
The results suggest that the brain is still able to track time elapsed under general anesthesia, recognizing that the body is not truly "asleep" under different forms of anesthesia and therefore still needs sleep for homeostasis.

"Our study demonstrates that the inhaled anesthetics appear to inhibit the neural systems required for REM sleep as well as cortical arousal. In ongoing and future studies, we are testing the idea that anesthetic-induced unconsciousness could simply be a NREM sleep-like state from which the anesthetized patient cannot be awakened," said Dr. Kelz. "Ultimately, if we could discover a novel anesthetic compound that produced a state of restorative NREM sleep from which the patient could not be awakened until the drug was removed, we believe we would be able to limit the side effects of existing anesthetic drugs."

The researchers caution that it is too early to make connections to current practices in humans, but these preliminary findings suggest that a study in humans is merited. "Our findings would suggest that these volatile anesthetics act in a fundamentally different way than the

anesthetic propofol," said Dr. Kelz. "As such, propofol might be a better choice for selective groups of patients, such as those with sleep apnea in whom dangerous complications of apnea (failure to breathe), hypoxia (low blood oxygen levels), and cardiac arrhythmias are known to occur more frequently during REM sleep," Dr. Kelz said.

More information:
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