

Parasomnias, Sleep, and the Effect of Anesthesia

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Case Study

A 60 y/o male was scheduled for abdominal surgery with general anesthesia. He reported a PMH of hypothyroidism (controlled with Synthroid), anxiety (controlled with Ativan, Buspar, and Prozac) and tobacco use of 1ppd x 3 yrs. While he had symptoms of RLS, he had never responded to any medications and currently c/o "leg cramps" causing an increased sleep latency. His VS pre-op were WNL. He seemed to understand the post-operative teaching and his plans were to be admitted for hospitalization for a few days then go home with a family member serving as a caregiver.

He was in surgery for approximately two hours and did well. His VS remained stable during surgery but he did experience more blood loss than was expected. He was sent to post-op for observation before being admitted to a hospital room. During his stay in post-op, he started making a whining noise and moving his legs uncontrollably. He started to wake up and c/o severe leg cramps and pain stating he "couldn't stand the pain any longer" (not from his abdomen but only with his legs). His legs were constantly moving and he was trying to get up. As his nurse you realize he is still under the effects of the anesthesia and is at risk for falls. What happened and what can you do to help the patient?

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Does Administration of Anesthesia Put You to "Sleep"?

Have you heard someone undergoing anesthesia be told "You are going to start to feel sleepy", or "You are going to feel sleepy and go to sleep for awhile" just before the anesthesia is given?
Is this correct? Is the patient "just going to sleep"?

The primary difference is: during sleep, brain waves vary from nonREM to REM sleep and with Anesthesia, brain waves stay in the same state for the length of anesthesia administration.

With General Anesthesia: you don't feel pain, you are not aware of your surroundings, you are not developing memories, and you cannot move your body. In addition, you maintain normal vital signs (consistent BP, HR, temperature). Of course with other types of anesthesia this varies. Is this the same during sleep...no.

McMurray, C. (2021). What's the difference between sleep and anesthesia? www. BrainFacts.org (associated with the Society for Neuroscience)

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How Anesthesia & Sleep Impacts the Brain?

- Anesthesia works on receptors in the brain (visual, thalamus, hippocampus and motor areas) that produces fluctuations or disruptions in the brain circuits that lead to a state of consciousness similar to a coma.
- While in sleep, the brain remains active. The **hypothalamus** impacts sleep and arousal; the **suprachiasmatic nucleus** within the hypothalamus receive information about light and control behavioral rhythm (explains why the blind may have sleep disturbances); the **brain stem** which controls transitions between wake and sleep and produces GABA (which reduces activity); the **thalamus** relays messages from our senses; the **cerebral cortex** processes information from ST to LT memory; the **pineal gland** (which produces melatonin); the **basal forebrain** which promotes sleep and wakefulness; the **midbrain** which acts as an arousal system (releases adenosine which supports your sleep drive). (Note: caffeine blocks the action of adenosine); and the **amygdala** which controls emotions and becomes very active during REM sleep.

NIH, Brain Basics: Understanding Sleep, Accessed 12/28/2021

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Normal Sleep Stages

- Sleep is divided into two primary stages: NREM and REM
- NREM has Stages 1, 2, and 3
Stage 1 and 2 are lighter sleep with Stage 3 deeper sleep where dreaming is possible
- REM sleep is deep sleep where vivid dreaming can occur with a loss of inhibition of voluntary muscles.



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Anesthesia & Sleep

Similarities

- Induced by medication
- Not based on circadian rhythm
- Both are actions or activities that intrudes on sleep.
- Both act upon the GABA receptors
- Both have overlapping areas in the brain that are acted upon
- Delayed recovery of alertness

Differences

- Occurs naturally
- Based on circadian rhythm
- With sedation the level of consciousness, pain and motor function are completely lost
- As anesthesia deepens, the EEG activity spreads to wider areas of the brain
- Anesthesia is divided into 4 categories whereas sleep is primarily divided into NREM and REM
- Quick recovery of alertness
- Genetics play more of a role in sleep than anesthesia (research continues with the worm, zebrafish, and fruit fly)

NIH. (2021). Brain Basics: Understanding Sleep, Accessed 12/28/2021

Brown, E. and Flores, F. (2019). General anesthesia causes telltale brain activity patterns. *The Scientist*. <https://www.the-scientist.com/features/general-anesthesia>

Song, J. Um, Y. Kim, T. Kim, S., Kwon, S., & Hung, S. (2018). Sleep and anesthesia. *Sleep Medicine Research*, 9(1), 11-19.

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In other words...



Anesthesia can lead to sleep deprivation, sleep fragmentation, loss of SWS and REM sleep (especially during the night after surgery), decreased sleep time, increased sleep arousals, poor sleep quality and frequent nightmares

Sleep typically returns to baseline in about 1 week

Of course the type of anesthesia, length or severity of surgery, age of patient, and use of opioids post-op can also influence sleep patterns

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Typical Side Effects of Anesthesia

- Temporary confusion
- Nausea and vomiting
- Sore throat (from artificial airway)
- Dry mouth
- Urinary retention
- Post-operative sleep disturbances



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Common Post-Operative Sleep Complications

- Post-operative fatigue
- Severe anxiety
- Depression
- Delirium
- Severe stroke
- In the older patient who may have decreased physical reserves and increased frailty impacting the brain and CNS leading to post-operative sleep disturbances
- Increased parasomnias

(Luo,M., Song,B., & Zhu, J., 2020)

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What Are Common Parasomnias? (Para- alongside; Somnus – sleep)

- Sleep walking (somnambulism)
- Sleep talking
- REM behavior movement disorder
- Sleep terrors
- Nocturnal dissociative disorder (not common but interesting to review)

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Somnambulism



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Description of Sleep Walking

- Occurs during stage 3 sleep
- Occurs more often with family hx, sleep deprivation, certain medications, alcohol usage, brain injury, fever (in children), OSA, RLS, stress, discomfort, or repeated nighttime awakenings
- May perform complex activities
- Concern with safety
- Usually not treated with medications
- Usually <10 minutes in duration but may last 30 minutes
- Person never has recollection of walking or events they did
- 29% sleepwalking occurs in children; only 4% adults sleepwalk

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Treatment of Somnambulism

- Safety, Safety, SAFETY
- Adequate sleep
- Avoidance of triggers: ETOH, or Medications that contribute to an incomplete arousal
- Anticipatory awakening
- CBT
- Melatonin
- Lastly: low dose benzodiazepines

- Lightly guide a person back to bed; don't awaken

Sun,E. and Vyas,N. (2021). Sleepwalking. <https://www.sleepfoundation.org/parasomnias/sleepwalking>

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Sleep Talking (Somniloquy)

Can occur in any stage of sleep.

More clear and sensible in Stage 1 and 2

More gibberish or nonsensical in Stage 3 and 4 (may sound like moaning or gibberish)

More common in children



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Triggers for Sleep Talking

- Stress (possible from anesthesia)
- Fever/Illness
- Alcohol
- Depression
- Sleep deprivation

- Treatment: none except good sleep hygiene

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REM Behavior Movement Disorder

- Acting out dreams (lack of atonia in REM sleep)
- Usually occurs in people over 50 yrs. (more common in men)
- Not associated with Mental Health issues or stress, etc...but can co-exist with Parkinson's disease, Lewy body dementia, narcolepsy or stroke. Can be associated with tricyclics and serotonin reuptake inhibitors or alcohol usage/withdrawal.



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Facts about Anesthesia Impacting Sleep

- Ketamine/diazepam created a longer post-anesthesia REM state with higher muscle tone
- Anesthesia creates hypnosis (unaware of surroundings), analgesia (lack of pain sensitivity), amnesia (lack of memory), and immobility after surgery which makes it possible for a patient to develop postop delirium or worsen dementia.
- Anesthesia disrupts the sleep/wake cycle and release of hormones and enzymes
- Inhalation anesthetics for GYN procedures create decreased melatonin levels

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REM Behavior Movement DO & Anesthesia

- Alpha waves are seen in REM natural sleep but not seen with general anesthesia
- As REM sleep occurs immediately with anesthesia, the sleep architecture is changed (impacting sleep for several days post-op)
- REM behavior movement DO decreases typically on day of anesthesia but can increase over the next few days (called rebound REM sleep)
- More research needed in this area

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Treatment of REM Behavior Movement Disorder

- **SAFETY** of patient and partner
- Clonazepam
- Melatonin
- Pramipexole
- Exelon or Aricept (best if disorder is associated with dementia)
- New drug Nelotanserin (a selective 5-HT '2A' inverse agonist) for pts with Lewy bodies or PD and RBM Disorder. Did not show significant improvement but still ongoing in clinical trials.

Stefani, A. (2021). Nelotanserin as symptomatic treatment for rapid eye movement sleep behavior disorder: A double-blind randomized study using video analysis in patients with dementia with Lewy bodies or Parkinson's disease dementia. *Sleep Medicine* (81): 180-187. doi:10.1016/j.sleep.2021.02.036.

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Sleep Terror

- Incidents of extreme terror occurring with sleep
- More common in children but adults with PTSD have high prevalence
- May show panic, fear, gasping, screaming while not being fully awake
- After the terror, the person typically returns back to sleep
- Usually **NO** recollection of the terror
- Occur in NREM (SWS) sleep
- Usually occur in the first part of sleep and last about 10 minutes up to 40 minutes
- Hereditary in nature



Pacheco, D. (2021). Night terrors. <https://www.sleepfoundation.org/parasomnias/night-terrors>

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Difference Between Night Terror and Nightmares

- Recollection of event
- Typically a person experiencing a nightmare has some idea about the dream whereas a person experiencing night terrors has no recollection.

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Treatment of Sleep Terrors

- Avoid trying to awaken the person as this may increase confusion
- Medication usually not required but in ongoing, severe cases, Clonazepam or Imipramine may be given
- Decrease stress levels
- Create a relaxing sleep routine maintaining regular sleep hours
- Monitor for safety and rid the environment of any electronic screens or noises
- "Break" sleep by waking up child 15 minutes before the terror starts keeping them awake for 5 minutes before they can return to sleep (continue this activity x 1 week). Night terrors usually start about 2 hours after the child goes to sleep

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Nocturnal Dissociative Disorder: Real or Myth

"Nocturnal dissociative disorder is a condition in which people leave bed and re-enact episodes of sexual or physical abuse"
www.medicinenet.com/parasomnia/definition.htm

- Interestingly, it was thought to be a sleep disorder but in 2005, ICD now classifies it as a psychological disorder. However, sleep medicine still treats this parasomnia
- Associated with PTSD, Anxiety, Schizotypal behavior, daytime dissociative disorder, and others
- It is a disorder with hallucinations, violent behavior, and even homicide (being more common with Nocturnal Dissociative Disorder than other types of dissociative disorders)
- It can occur in any stage of sleep, or within several minutes after awakening from non-rapid eye movement (NREM) sleep or rapid eye movement (REM) sleep

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Nocturnal Dissociative Disorder

- Re-enactment of physical abuse or trauma often self-inflicting harm
- Much less common than dissociative disorders with multiple personalities
- Have **limited multiple** personality disorder
- Homicidal behaviors are increased with Nocturnal Dissociative DO when compared to daytime Dissociative disorders and multiple personalities
- Nocturnal dissociative disorder arises from wakefulness. Sleep hallucinations, nightmares, sleep paralysis, and REM Behavior Movement Disorder are arousals during REM sleep.

Agargun, M., Kara, H., Özer, O.A., Semiz, U., Selvi, Y., Kiran, U., & Tombul, T. (2001). Characteristics of patients with nocturnal dissociative disorders. *Sleep and Hypnosis*, 3, 131-134.

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Examples of Violent/Homicidal Dissociative Disorder



SECOND EDITION.



Horrible MURDER and Attempted Arson in Boston!

A woman was murdered this morning about 4 o'clock, at a house in Cedar Lane, near Cambridge Bridge, recently occupied as a house of prostitution by the notorious Julia King. Of the general character of the house we are not informed.

The murdered person was a Mrs. Bickford, and her husband is now absent in the state of Maine. Her street was cut nearly from ear to ear, and the bed set on fire in order to conceal this act of atrocity.

We are requested not to give further particulars until the holding of the Coroner's Inquest, which we trust will develop the particulars of this horrid affair, and be the means of bringing the murderer to justice.

Abbott, K. (2012). The case of the sleepwalking killer. *Smithsonian Magazine*. <https://www.smithsonianmag.com/history/the-case-of-the-sleepwalking-killer-77584099/>

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Dissociative Experiences Scale - II (sample)

Instructions: This questionnaire asks about experiences that you may have in your daily life. We are interested in how often you have these experiences. It is important, however, that your answers show how often these experiences happen to you when you are not under the influence of alcohol or drugs. To answer the questions, please determine to what degree each experience described in the question applies to you, and circle the number to show what percentage of the time you have the experience. For example: 0% (Never) 10 20 30 40 50 60 70 80 90 100% (Always) There are 28 questions. These questions have been designed for adults. Adolescents should use a different version.

1. Some people have the experience of driving or riding in a car or bus or subway and suddenly realizing that they don't remember what has happened during all or part of the trip. Circle the number to show what percentage of the time this happens to you. 0% 10 20 30 40 50 60 70 80 90 100%
2. Some people find that sometimes they are listening to someone talk and they suddenly realize that they did not hear part or all of what was said. Circle the number to show what percentage of the time this happens to you. 0% 10 20 30 40 50 60 70 80 90 100%
3. Some people have the experience of finding themselves in a place and have no idea how they got there. Circle the number to show what percentage of the time this happens to you. 0% 10 20 30 40 50 60 70 80 90 100%
4. Some people have the experience of finding themselves dressed in clothes that they don't remember putting on. Circle the number to show what percentage of the time this happens to you. 0% 10 20 30 40 50 60 70 80 90 100%

Carlson, E.B. & Putnam, F.W. (1993). An update on the Dissociative Experience Scale. *Dissociation* 6(1), p. 16-27.

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Treatment in Post-Operative Area

- Assess for possible risk factors such as prior trauma or victimization
- Be aware of possible behavior and monitor for safety
- Little research done looking at how anesthesia directly impacts this disorder but considering it can be linked to depression or anxiety, monitor for those effects
- Have sleep medicine and mental health involved should behavior be noted

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Effect of commonly used sedatives and analgesic drugs

Georg, S., Liu, Y., Kikic, T., Khat, S., & Kooze, S. (2019). Sleep and anesthesia. *Sleep Med Res*. <https://www.sleepmedres.org/journal/view.php?number=107>

Substance	Consequence
Benzodiazepines	Reduce sleep onset latency
	Worsen sleep quality
	Reduce later stage of SWS
Intravenous anesthetic agent	Increase airway collapsibility
	Varies by circumstances
	May improve or exacerbate poor sleep quality
Analgic Agent	Increase airway collapsibility
	Increase SWA
	Reduce number of awakenings
	Induce psychotropic side effects during sleep
Benzodiazepine antagonist	Avoids respiratory events
	Worsen sleep quality
	Reduce SWS and REM sleep
	Increase Stage 1 sleep
	May induce respiratory suppression
Other Adjuvant	Favorable effect on patients with periodic limb movement
	Improve sleep quality
	Increase sleep efficiency and SWS
	Treat EDS and hypersomnolence
Benzodiazepine antagonist	Unfavorable effect on sleep deprived patients
	No effect on respiratory pathway
	More aroused after anesthesia
Other Adjuvant	Avoids respiratory events

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Case Study: What happened?

- Age?
- General anesthesia for abdominal surgery?
- PMH of RLS
- Loss of Blood leading to decreased iron levels
- Resulting in worsening of RLS symptoms

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Treatment of Post-Operative RLS

- Early ambulation
- May consider IV (opioids) or transdermal (Rotigotine) medications to help if not contraindicated
- Iron supplementation if needed
- Stretching
- Use of compression devices
- Reduce caffeine
- Smoking cessation



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Summary on Anesthesia & Parasomnias

- General anesthesia creates hypnosis, analgesia, amnesia, and immobility, thus altering the natural circadian rhythm
- Patients with prior sleep disorders are more prone for post-operative parasomnias
- The amount of anesthesia, the type of anesthesia and the length of usage affects the brain's neuroendocrine cells (which work on sleep patterns)
- GABA neuronal activity is impacted, disrupting the sleep wake cycle
- General anesthesia affects melatonin levels
- Gaseous anesthetic agents can cause sleep fragmentation with some (Sevoflurane inhalation) inducing REM sleep deficits
- If opioids are used in combination with anesthetics, the risk of parasomnias are greater

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References

Agargun, M., Kara, H., Özer, O.A., Semiz, U., Selvi, Y., Kiran, U., & Tombul, T. (2001). Characteristics of patients with nocturnal dissociative disorders. *Sleep and Hypnosis*, 3, 131-134.

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Thank you for your participation.



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