

What is Sleep? What are Sleep Stages?

There are a number of topics about sleep that are of particular concern to people with epilepsy. First, sleep disruption from any cause can be a reason for an increase in seizure frequency or severity. Second, sleep disruption can also have a negative effect on short-term memory, concentration, and mood. Seizures during the night can disrupt sleep, possibly resulting in further problems with memory and concentration the following day. Finally, various anticonvulsant drugs can affect sleep in both positive and negative ways.

Contrary to popular belief, sleep is not simply a state in which the brain is resting, but a dynamic, complicated condition during which the brain is quite active. There are different stages of sleep (as described below) and each differs in areas such as the type of brain activity occurring, the ease of awakening, and the presence of certain sleep disorders. Certain stages of sleep may be particularly important not only for maintaining alertness, but also for consolidating learning and memory.

What are the stages of sleep?

Sleep is not a static condition, but a complex series of sleep stages that repeats itself in a characteristic pattern over a night's sleep. There are five distinct stages of sleep: stages 1, 2, 3, and 4 (all of which comprise "non-REM sleep"), and the fifth stage, REM (rapid eye movement) sleep. Each stage of sleep is defined by specific electrical patterns in the brain. While a person sleeps, it is possible to detect each of these sleep stages using a device which senses the electrical activity in the brain, called an electroencephalogram (EEG). There are also characteristic changes in muscle activity, eye movements, and breathing during the various stages of sleep. Measurement of sleep and evaluation of sleep disorders is performed using a technique called polysomnography, where sensors are used to measure brain and muscle activity, eye movements, breathing, and sometimes other parameters such as oxygen in the blood, leg movements, and the cardiogram (EKG).

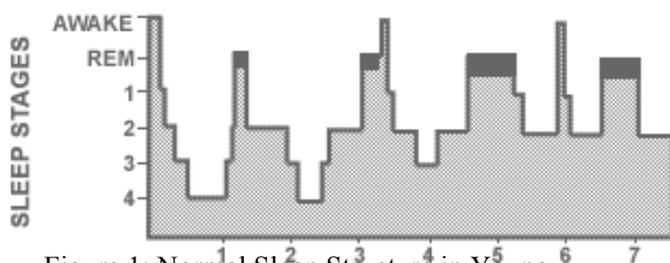


Figure 1: Normal Sleep Structure in Young
Kales and Kales. N. Engl. J. Med. 1974;209:487-499

During a normal night, the brain cycles through the different sleep stages from stage 1 to REM and then begins again with stage 1 (FIGURE 1). During some stages (particularly light non-REM sleep), the person can be awakened more easily, while during deep non-REM sleep it is particularly difficult to awaken.

Waking

When someone is awake, their brain is occupied with many functions. The patterns seen on an EEG during the waking period are "chaotic", meaning that different patterns occur independently. During waking, breathing is irregular and there is typically a lot of muscle and eye movement activity.

Stage 1

Stage 1 sleep could also be considered drowsiness. During this stage, a person's eyes are closed, their breathing becomes more regular, and they have slower, rolling eye movements. They are also less aware of their surroundings than during the waking stage, but are easily aroused back to full wakefulness. This stage can occur when a person is quietly resting; "dropping off" briefly while watching television, reading, or being at an uninteresting lecture. The person may also have what are known as "hypnagogic experiences" - dream-like sensations of falling, hearing voices, or seeing flashes of pictures. Stage 1 may last for five to 10 minutes at the beginning of sleep, and accounts for a relatively small percentage of total sleep time (about 5%) in healthy adults.

Stage 2

During Stage 2 sleep, the person is even less aware of their surroundings, but is still easily arousable. During this stage, the person's heart rate slows, breathing becomes even more regular, and their body temperature decreases. Muscles relax further. Brain activity shows some characteristic patterns, called sleep spindles and K-complexes, which are not seen during wakefulness or drowsiness.

Stages 3 and 4

Stages 3 & 4 are deep sleep stages also referred to as "SLOW WAVE SLEEP". Brain activity shows slower, more regular patterns. Muscles relax further, and breathing is very regular. During these stages, especially in stage 4, it is extremely difficult to arouse the sleeping person. Most people have had the experience of being awakened 30-60 minutes after falling asleep by the telephone, and finding themselves very confused for a few minutes or even not remembering the conversation the following day. This most likely occurs from being woken up from slow wave sleep.

REM sleep

REM is very different from the other stages of sleep. Brain waves actually look more like the "chaotic" patterns seen in wakefulness than like other stages of sleep. In fact, the brain is very active during REM sleep, but the sleeping person is not aware of their surroundings. Most dreaming occurs during REM sleep. Although brief dream images can occur during other stages, the kind of complicated, bizarre, plot-driven experiences most people think of as dreams occur during this stage. Many researchers believe that REM sleep in particular is required for the consolidation of certain types of memories.

During REM sleep, the body is normally paralyzed although brief twitching can occur. It is for this reason that although the brain is very active with dreaming, no movement occurs. Sometimes this paralysis can persist briefly after awakening, particularly in a person who is sleep deprived. This may be frightening but is completely normal. More prolonged sleep paralysis can occur in people with a neurological condition called narcolepsy.

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