

Sleepwalking in Children

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Abstract

Sleep walking, or somnambulism, is an arousal parasomnia affecting people during slow wave sleep, primarily during the first half or third of the night that results in large, coordinated, complex behaviors that commonly occurs in children reaching a peak at age 12 years, and decreasing afterwards. It has been described as an incomplete arousal from sleep that has been recently shown to be associated with NREM sleep instability, often caused by sleep disordered breathing.

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Definition and Classification of Sleep Walking

From the International Classification of Sleep Disorders, arasomnias are events or sequences occurring during the transition from awake to sleep, during sleep, or during an arousal from sleep.¹ These are different from sleep associated movements that are simple, repetitive, fragmented, dyskinetic movements such as rocking, grinding, cramps, bruxism, or periodic leg movements. Instead, parasomnias are complex, seemingly purposeful and goal directed movements, such as sleep eating, walking, talking, driving, and etc.

Parasomnias can be further broken into those that arouse from NREM or REM sleep. As the amount of REM sleep varies during different portions of the night, NREM related events tend to occur in the first third of the sleep period, and REM related events in the last half of the sleep period. Sometimes REM behavior disorder (RBD) can be confused with sleep walking because of certain shared features. RBD, however, is a lack of atonia during REM sleep, and allows patients to act out their dreams. The timing of the event within the night,

the ability to recall dream content, and certainly atonia via polysomnographic (PSG) recording will distinguish these two entities.

Features

In a typical attack of somnambulism or sleepwalking the individual sits up quietly, generally an hour or two after falling asleep, gets out of bed, and moves about in a confused and clumsy manner. Soon his behavior becomes more coordinated and complex. He may avoid objects, dust tables, go to the bathroom, or utter phrases which are usually incomprehensible. It is difficult to attract his attention. If left alone, he goes back to bed. A great deal of stimulation is required to awaken him. And when he is awakened he has little if any recollection of his sleepwalking activities and no recollection of dreaming. Nevertheless, these remarkable attacks are almost universally interpreted as an “acting out of dream activity”²

Events such as sleep walking, sleep talking, sex, eating, confusional arousals, and night terrors are thought to be NREM arousal parasomnias that often occur during the first part of the night.^{3,4} In addition to the above description, sleep walking can also suddenly start, with a patient jumping or bolting out of bed without warning. Typically, consciousness is impaired, and patients often cannot recall the event afterwards; the patient may have the impression of doom or frightening imagery. Talking or shouting can occur simultaneously, and the entire event can cease spontaneously, either at the initial

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location or elsewhere.¹ Sleep walking is often regarded a part of normal development in this child, but as an adult inappropriate activity to self and others can cause harm and embarrassment.

Sleep walking can also be described as normal activity at an abnormal time or abnormal activity at an abnormal time. For example, the act of eating, driving, talking, and walking appears routine and similar to daytime activity and would be appropriate if it were not in the night. In contrast, reports of urination in a waste basket or moving furniture haphazardly, climbing out of a window reveals sleep walking's purposeful and complex behavior, but mal-directed and mal-timed.

Prevalence of Sleep Walking

The reported prevalence of sleepwalking differs depending on age, and peaks around the ages of 8 to 12, where it can be as high as 17%. After this, the prevalence drops during adolescence. About 4% of adults report sleep walking. There is a familial pattern to sleep walking, with increased prevalence with increased number of parents also afflicted. However it is unclear if the familial element is related to sleepwalking or the underlying cause behind the abnormal sleep leading to sleepwalking. In a large Finnish study regarding children from ages 7 to 17, sleepwalking occurred "often" in 3% of boys and girls, occurred occasionally in 25% of boys and 24% of girls. Some studies have shown that increased anxiety (as reported by mothers regarding their children) can increase the prevalence of parasomnias such as night terrors, sleep talking, bruxism, although not sleepwalking.⁵

Mechanism of Sleep Walking

Arousal from fragmented slow wave sleep (SWS) is usually the timing of the sleep walking event, and different arousals have been noted. Some sources are internal, such as sleep disordered breathing or a distended bladder.⁶ Other sources are external, such as noise or light stimuli.^{6,7} Some medical conditions, such as hyperthyroidism, encephalitis, or head trauma have also been implicated.¹ In chronic sleepwalkers, events have been shown to occur more commonly after abrupt sleep deprivation, increases in daytime stress and anxiety, fever, and alcohol intake.

In the recent past, it has been found that sleepwalking

event in chronic sleepwalker occurs on a background of instability of NREM sleep, related to another cause. Controversies on the role of hypersynchronous delta bursts often seen just preceding the beginning of the event has been present for some time. The controversy has been only recently resolved with the usage of the cyclic alternating pattern scoring manual to analyze sleep of sleepwalker as shown below. The Montreal and Stanford groups performed an EEG analysis on the sleep of chronic sleep walkers and compared them to controls. The controls had a high and normal slow wave activity (SWA) during the first 2 sleep cycles. However, the chronic sleepwalking group had a significant decrease in slow wave activity (SWA). Further studies called upon analysis of the sleep EEG looking for the presence of an abnormal cyclic alternating pattern (CAP) rate in these subjects⁸: One way to evaluate the stability and consistency of SWS is to examine the presence of CAP.

CAP represents electrocortical events seen as abrupt changes of amplitude and frequency during NREM sleep. If there is difficulty progressing from wake to REM (through NREM sleep), the amount of CAP activity will increase. It is also noted during micro arousals, often caused by a breathing disturbance. In these cases, the macro structure of sleep can be preserved, but the microstructure can become significantly altered.

A study was done questioning whether there are any differences the sleep of pre pubertal children who chronically and frequently sleep walk and those who do not, particularly regarding SWS.⁸ In this study, the amount of cyclic alternating patterns found were significantly increased in the chronic sleepwalkers as compared to the control group suggesting that the NREM sleep in chronic sleepwalkers is less stable than controls.

A similar study was performed in adults and similar results were found. Combining the two analyses (CAP and quantified EEG analysis) on a few subjects showed regions of high amplitude delta (phase A1 of CAP), similar to what is seen in the normal progression from stage 2 to stage 3 NREM sleep. However, the progression of sleep toward SWS and stage 4 NREM sleep was inhibited and the EEG went back to a background EEG (phase B of CAP). Also, the phase A was not a pure delta but had some fast activity as described as phase A2 or even alpha EEG short arousal (phase A3 of CAP). Quantified EEG analysis showed an increase in the relative power of delta frequencies and the alpha frequencies with these events. Delta bursts and their

interruption and return toward a background (stage 2 NREM sleep) EEG is concordant with an overall decrease in delta activity during the first 2 sleep cycles. Guilleminault hypothesized that the abnormalities seen were not the presence of burst of delta waves (phase A) but their interruption and return toward background EEG (phase B). Very recently Bruni et al (personal communication) performing quantified EEG analysis and analysis of distribution and length of phase A and B of CAP found supporting evidence for this hypothesis.

What is causing unstable NREM sleep? Efforts were made to look at polysomnography of sleepwalkers with appropriate monitoring of many biological functions. It was shown that other subtle sleep disorders were associated with sleepwalking. Increasing any stimuli during sleep time, therefore, can increase the likelihood sleep walking will occur. In the study noted above, treating the underlying condition, OSA/ UARS, eliminated the children's parasomnias in all affected children.⁶ Similar findings were seen in adults.

Treatment of Sleep Walking

Treatment of sleep walking depends on the risk of hazards from the activity and the presence of comorbid conditions. If sleep walking poses no immediate hazard, it can be treated conservatively. If there is suspected OSA / UARS that would need to be evaluated.

Sleep walking, however, can pose an immediate hazard if the patient sustains continued trauma from this activity. Firstly, the environment must be made safe. Removal of harmful objects, such as sharp objects, glass, mirrors should be removed from the room. Windows should be locked, and heavy drapes be placed. Keys should be hidden and access to firearms should be minimized. The patient should not have access to stairs, and should sleep on the ground floor on a mattress close to the floor.

Medications have been tried in the past (for adults) and have been occasionally helpful. Benzodiazepines can consolidate sleep and reduce reactivity to arousal triggering events by affecting GABA receptors to increase sedation. It has been traditionally thought that another method of reducing SWS arousal parasomnias with benzodiazepines was by decreasing the amount of SWS, but some drugs in this class, like clonazepam, both increase SWS and decrease parasomnias. Imipramine, a tricyclic antidepressant that blocks H1 and H2 receptors that can be used to treat enuresis has been shown to

decrease sleep walking by decreasing response to arousal triggers.⁹

Conclusion

Sleep walking is an underreported condition whose prevalence increases during childhood peaking at 10 to 12 years of age, and usually decreases during adolescence. It can pose long term consequences if associated with sleep over eating, or immediate consequences by allowing physical trauma during the events. Children with chronic sleep walking have been found to have fragmented slow wave sleep, and treating the causes of fragmented sleep, namely OSA / UARS, have been shown to effectively treat this condition.

However, how sleepwalking occurs on a background of NREM sleep instability is not completely resolved because not all subjects with unstable NREM, whether it be from sleep disordered breathing or abnormal limb movements, present with chronic sleepwalking. It seems that there must be a worsening of the NREM instability by daytime behavior. Also stress and anxiety may leave a "memory trace" that may be very prominent during a confusional arousal and may lead to terror, escape, or fugue behavior. However these last issues are still not well demonstrated.

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