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Parasomnias of Childhood and Adolescence

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It is simplistic and mistaken to think that sleep is a quiescent part of life, initiated by the mere shutting down of wakefulness. Increasingly, complexities are being revealed about the mechanisms underlying the onset of sleep and the repeated switching from non–rapid eye movement (NREM) sleep to REM sleep during the night, not to mention the complicated control of circadian sleep-wake rhythms (as discussed elsewhere in this issue). Moreover, the three basic states of wakefulness, NREM sleep, and REM sleep are not necessarily discretely separated, because some conditions show combined features of all three. The many parasomnias now officially recognized are evidence that sleep commonly is interrupted by changes of behavior or experience in various ways, some subtle, others dramatic. This article is concerned with such changes seen in childhood and adolescence. At these stages of development there may be features different from those seen in adult parasomnias.

An intriguing embryonic account of children's parasomnias was provided a long time ago. In his

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1545 *Boke of Chyldren* (the first pediatrics textbook written in England), Phaire [1] described what he considered to be the "infirmities" to which children were particularly prone, together with his recommended treatments. Four types or causes of sleep problems were included: "watching out of measure" (sleeplessness), "colyke and rumbling in the guttes" (infantile colic), and two parasomnias, "terryble dreams and feare in the slepe" (caused by the "arising of stinking vapors out of ye stomake" and treatable by various means such as "a little hony to swallow" or "a lytle pouder of peonie"), and "pyssing in bedde," for which powders made from "the wesande' (windpipe) of a cocke" or from "the stones of a hedgehogge" were considered therapeutic. The evidence base for these remedies is not stated!

The 2005 version of the International Classification of Sleep Disorders (ICSD-2) [2], which contains some concessions to pediatric aspects, represents something of an advance on Phaire's account. In it, 23 types of parasomnias are described, including 8 sleep-related movement disorders, plus a few other symptoms and sleep-related events of a parasomnia-like nature.

In the interests of clinical utility, the structure of this article departs somewhat from the ICSD-2 coverage of the parasomnias, mainly in the following respects:

1. Primary parasomnias (sleep disorders in their own right) are considered separately from secondary parasomnias, which are manifestations of physical, behavioral or psychiatric disorders.
2. The primary parasomnias are considered more completely, according to the phase of sleep with which they are usually associated. This approach gives the timing of their occurrence some diagnostic significance (Box 1).
3. Greater emphasis is placed on childhood aspects of these conditions. There is, however, an inherent problem in making the selection because of the lack of comprehensive, detailed surveys of sleep disorders in children. Because epidemiologic studies have predominantly concerned adults, the occurrence of some parasomnias (especially those whose detection relies heavily on subjective information) may be underestimated in young people. Therefore it is advisable to be familiar with the whole range of ICSD-2 sleep disorders, in case some disorder not conventionally associated with children is, in fact, encountered.

This article is essentially concerned with the clinical aspects of parasomnias in both children and adolescents. Because full referencing is beyond the scope of the article, the citations provided are restricted to those considered particularly relevant to the parasomnia in question or to points less likely to have been made previously. In that sense, they are intended to emphasize or to complement references provided in other accounts [3]. In the relative absence of randomized trials or meta-analyses, the evidence base consists largely of published clinical experience.

Box 1: Main primary parasomnias related to phase of sleep

Presleep and sleep onset
Sleep starts
Hypnagogic hallucinations
Sleep paralysis
Rhythmic movement disorder
Restless legs syndrome

Light NREM sleep
Bruxism
Periodic limb movements in sleep

Deep NREM sleep
Arousal disorders
Confusional arousals
Sleepwalking
Sleep terrors

REM sleep
Nightmares
REM sleep behavior disorder (sometimes a secondary parasomnia)

Waking
Hypnopompic hallucinations
Sleep paralysis

Various stages of sleep
Sleep talking
Nocturnal enuresis

The following general points about childhood parasomnias have clear implications for clinical practice.

- **Precise diagnosis is important because different parasomnias may need contrasting types of treatment. Accurate diagnosis depends principally on a detailed account of the subjective and objective sequence of events from the onset of the episode to its resolution and of the circumstances in which the episode occurs, including its timing. Audiovisual recording (including the use of home video systems) can be very informative. Only occasionally is polysomnography (PSG) required, although its use can be instructive where clinical evaluation is inconclusive and, sometimes, where there is the possibility that another type of sleep disorder coexists.**

- **The more dramatic forms of parasomnia seem to be a particular cause of diagnostic confusion and imprecision and also of quite possibly unnecessary concern about their psychologic significance; most are benign.**
- **Especially when the range and manifestations of sleep disorders are not understood, parasomnias (and other sleep disorders) may be misinterpreted as other physical or psychologic conditions [4].**
- **A child may have more than one kind of parasomnia or, indeed, more than one sleep disorder (eg, arousal disorders associated with obstructive sleep apnea [OSA]).**
- **Because many childhood primary parasomnias remit spontaneously within a few years [5], children and parents often can be reassured about the future, although protective measures (eg, in severe head banging or sleepwalking) may be required in the meantime.**
- **Specific treatment, including medication, is needed in only a minority of cases of primary parasomnia but is likely to be required for the underlying disorder in many of the secondary parasomnias.**
- **Research information on this point is limited, but a primary parasomnia might be symptomatic of a psychologic problem if it is very frequent, unusually late in onset or persistent, or associated with a traumatic experience.**
- **Parasomnias may lead to psychologic complications if the child is frightened, embarrassed, or otherwise upset by the experience or by the reactions of other people to the episodes.**

General definition of the parasomnias

Parasomnias can be thought of as unwelcome physical events or experiences that occur predominantly or exclusively during entry into sleep, within sleep or during arousals from sleep.

Primary parasomnias in the presleep period or at sleep onset

Sleep starts

Many phenomena that occur in the process of falling asleep are common and do not have any pathologic significance, although they may cause concern. Sudden, usually single jerks of the limbs or other parts of the body at sleep onset ("hypnic jerks") occur at all ages and can be considered normal. They may be preceded by hallucinatory experiences (see later discussion) including a feeling of falling. Sensory equivalents to these movements include flashes of light, a loud bang, or a crack or snapping noise, called the "exploding head syndrome" [6], and sudden pain or other unpleasant sensation. Both types of these so-called "sleep starts" are essentially benign, although some association with stress is possible, and, rarely, accidental injury may occur with particularly vigorous movements. Their basic nature and frequency at any age are not known, but they can be considered a possibility in young patients. This sleep disorder should not be confused with epilepsy. Frequent sleep starts have been described in brain-damaged children, in whom they may well be interpreted as epileptic in nature [7], although the two conditions may coexist in this group of children.

Hypnagogic hallucinations

Hypnagogic hallucinations may accompany sleep starts but often occur separately. They can form part of the narcolepsy syndrome, and in that setting they can be particularly intense and terrifying. The far more usual and isolated form, consisting of a combination of a dreamlike state in which objects (including people or animals) may be seen, heard, felt, smelled, tasted, or distorted, also can be frightening. Personal body-image distortions may occur also. Again, these experiences and their counterparts on waking (hypnopompic hallucinations) usually do not signify physical or psychologic disorder.

Sleep paralysis

Sleep paralysis (classified in ICSD-2 as a disorder of REM sleep) consists of recurrent brief episodes of inability to move or speak, either when going to sleep or on awakening, usually from a dream. Eye and respiratory movements are spared, but there often is a feeling of not being able to breathe. The episodes end spontaneously after lasting several seconds to a minute or two or with external stimulation such as being touched or moved.

Sleep paralysis forms part of the narcolepsy syndrome, which should be readily distinguished by the presence of its characteristic features although many of its forms of presentation are at particular risk of being misinterpreted as other clinical conditions [8]. Much more often, however, sleep paralysis occurs independently, and in rare cases it is familial. As an isolated phenomenon it seems to be common in adults and may well occur in children, although how often is not known. Understandably, it can be very frightening, but reassurance that it is a benign is appropriate.

The episode of paralysis may be accompanied by hallucinatory experiences or dreamlike experiences that can be especially dramatic and alarming. The

presence of people or creatures that take on a threatening aspect or a feeling of an alien presence may be experienced. Such experiences may be misinterpreted as psychotic illness [9]. Isolated sleep paralysis is likely to be self-limiting. If the episodes are frequent (which is not often the case), avoidance of sleep loss or disruption may be a helpful measure.

Rhythmic movement disorder

Rhythmic movement disorder [10] consists of stereotyped movements, mainly of the upper part of the body. The movements usually occur at sleep onset but also in relation to nocturnal wakings for any reason and sometimes at the end of the sleep period. In normal children the activity is pleasurable and may be viewed, at least partly, as an aid to getting to sleep or returning to sleep following waking during the night. Other examples during NREM or REM sleep have been reported.

Head banging is the usual form of movement, with either forward or backward movement onto a pillow or perhaps a hard surface such as the cot sides or the wall. Head rolling and rolling or rocking movements of the whole body are other varieties of rhythmic movement disorder. Combinations of these various movements can occur. Often there are accompanying rhythmic vocalizations such as humming. Individual episodes usually last up to 15 minutes but can be much longer.

Many children (mainly boys) exhibit some form of sleep-related rhythmic movements in their first year of life, but the behavior almost always stops spontaneously by 3 to 4 years of age. Therefore parents can be reassured that, although the behavior may look bizarre, it is a passing phase that is not associated with any psychologic or physical disorder. In what should be unusual cases of diagnostic uncertainty, electroencephalographic (EEG) monitoring during episodes is appropriate to explore the possibility of epilepsy.

Treatment usually is not needed except perhaps for protective measures such as padding the cot sides. In this respect, sleep-related rhythmic movement disorder contrasts with rhythmic movement disorder occurring repeatedly during the day, which often is a feature of severe developmental delay or some other form of serious psychiatric condition such as autism. Here the risk of head injury from head banging, including skull trauma and damage to the eyes, seems to be much greater than in sleep-related head banging.

Occasionally, more vigorous intervention is necessary because of serious disruption of the child's sleep, embarrassment, annoyance caused to others by the noise generated, or risk of injury. A number of treatments have been reported to be effective in some cases. The various means of helping the child to get to sleep are important, including preventing the child from spending long periods in bed awake at bedtime. Otherwise, specific behavioral methods, such as the use of reward systems or measures to discourage the movement (including avoidance of inadvertent parental reinforcement of the behavior by paying too much attention to it), may be useful. Other psychologic treatments said to have been effective (mainly in individual case reports) include measures based on feedback, practicing head movements incompatible with actual head banging, and various reward systems. Sometimes, short-term benzodiazepine medication is justified. Underlying predisposing factors might need attention.

Restless legs syndrome

Perhaps as many as 10% of adults complain of episodes of restless legs syndrome (RLS), especially when resting (mainly in the evening), in the presleep period, or on waking at night. They report a need to move their legs (and sometimes other parts of their body) in response to very uncomfortable, unpleasant feelings. Children may have difficulty describing these feelings (eg, referring to them as "creepy-crawly" sensations). Walking or otherwise moving the legs provides some relief from this distressing experience. A high proportion of sufferers date the onset of their symptoms to childhood, and it is thought that RLS may well be the diagnosis in some cases of childhood "growing pains" [11].

The condition often runs in families (possibly as an autosomal dominant disorder) but can be associated with physical conditions including iron deficiency (for which serum ferritin level estimation is the most appropriate test), various other medical conditions, caffeine intake, and the use of certain medications such as some antidepressants. RLS needs to be distinguished from the usual behavioral bedtime problems or other causes of difficulty falling asleep or of sleepiness during the day. Other reasons for leg discomfort at night should be considered including rheumatologic disorders and peripheral neuropathy. Most people who have RLS also have periodic limb movement disorder (PLMD), as discussed later, but only a minority of those who have PLMD also have RLS. Treatment possibilities are discussed in the section on periodic limb movements in sleep.

Primary parasomnias associated with light non–rapid eye movement sleep (stages 1 and 2)

Bruxism

Bruxism is forceful grinding and clenching of the teeth in a paroxysmal fashion, sometimes

producing a loud grinding noise at night without the child's being aware. Bruxism usually occurs in light sleep but may occur at any stage of sleep. It is thought to be particularly common in adults (although it is a serious problem in only a minority) and to be caused by a number of physical or psychologic factors (eg, stress may precipitate or worsen the condition), although its origin may not be clear.

It has been reported to occur in up to 20% of children who may complain of pain in the face or headache. In severe cases, the child's teeth may be damaged. Treatment, if needed, is determined by the cause or associated factors, but the range of suggested remedies for adults (from wearing a rubber teeth guard at night if dental damage is occurring, to psychotherapy in the presence of good evidence of an underlying emotional problem) indicates the need for careful consideration of each individual case.

Periodic limb movements in sleep

Periodic limb movements in sleep (PLMS) are brief and stereotyped muscular contractions (usually about 2 seconds in duration) mainly affecting the toes, knees, and hips, typically at intervals of about 20 to 40 seconds and usually without any awareness [12]. Predominantly, they occur in NREM sleep with or without PSG evidence of arousal. Their severity is expressed as the number of movements (with or without arousals) per hour. In both adults and children, periodic limb movement disorder (PLMD) is diagnosed if the rate exceeds five per hour with clinical evidence of sleep disruption or excessive daytime sleepiness.

PLMD has been viewed as a cause of excessive daytime sleepiness in adults (because of the fragmentation of sleep caused by repeated arousals), either as a cause in its own right or as a contributory factor in other sleep disorders with which it may coexist, such as OSA or narcolepsy. It is suggested that PLMS is related to impairment of dopaminergic systems. PLMD can be associated with iron deficiency anemia, various metabolic disorders, the use of antidepressants, or the withdrawal of various other drugs that act on the central nervous system, all of which should be considered as the possible underlying cause. Detection of PLMD involves anterior tibialis and arousal monitoring as part of extended PSG.

Both PLMS and RLS have been considered rare in children and adolescents. In recent years, however, reports have suggested otherwise, although the true prevalence is not known. PLMS in particular has been implicated as a cause of daytime attention deficit hyperactivity syndrome symptoms, supposedly as a result of insufficient or poor-quality sleep [13]. Awakenings at night and daytime sleepiness are other possible effects that may improve with treatment. Of the various factors that can underlie sleep disturbance in children who have a learning difficulty (mental retardation), PLMS has been particularly implicated in Williams syndrome [14] and Angelman syndrome [15].

Detection rests on evidence of jerking movements during sleep or very restless sleep. PSG is required for full evaluation of PLMS, actigraphy being disappointing as a means of evaluating the condition in children. PLMS should be differentiated from sleep starts and myoclonic seizures. Conditions somewhat clinically similar to RLS include muscle cramps, peripheral neuropathies, and certain muscle disorders.

Response to various reported treatments for both RLS and PLMS (best confined to patients who have sleeplessness, excessive sleepiness, or other daytime problems convincingly caused by these sleep disorders), such as dopaminergic agents, clonazepam, opioids, and some antiepileptic agents, seems to be variable in adults. In the absence of information about specific treatment in young patients, emphasis should be placed on good sleep hygiene (perhaps especially caffeine restriction), although medication may be justified in some cases. In the case of RLS, some benefit may be gained from avoiding caffeine in particular, taking iron supplements, and engaging in moderate exercise in the evening, and, because of the link with inactivity, not going to bed until ready to sleep rather than lying in bed awake. The prognosis in young people is unknown.

Primary parasomnias associated with deep non–rapid eye movement sleep (stages 3 and 4)

General points

Disorders of arousal (ie, confusional arousals, sleepwalking, and sleep terrors) are very common in childhood. In a minority they persist into adult life, and in a few they begin in adolescence. Arousal does not mean that the child wakes up; the arousal is, in fact, a partial arousal usually from deep NREM (slow-wave) sleep to another, lighter stage of sleep. In such arousals, various behaviors can occur that are either simple in nature (for example, sitting up in bed and mumbling) or complicated (eg, rushing out of the house in a highly agitated state). Other, more complex behaviors occasionally described in young people include aggressive acts and sleep-related eating disorders. The child remains asleep during the episode itself, failing to recognize the parents or be comforted by them, although the

episode sometimes ends with waking, particularly in later childhood or adolescence.

Usually only one episode occurs during the night, within the first 2 hours or so after going to sleep when slow-wave sleep is most abundant. Some children predisposed to arousal disorders also have such arousals arising from light NREM and REM sleep, giving rise to multiple episodes throughout the night. Such repeated episodes usually are less dramatic each time. Partial arousals are possible during daytime naps.

The main predisposing factor is genetic: a first-degree family history of partial arousals has been reported in most cases, the fundamental pathophysiologic feature seeming to be instability of deep NREM sleep. Precipitating factors, in constitutionally predisposed individuals, include fever, systemic illness, central nervous system–depressant medication or other substances, internal or external sleep-interrupting stimuli (eg, having a full bladder, sleeping in an unfamiliar environment, or being awakened forcefully by a sudden noise), other sleep disorders that interrupt sleep such as sleep-related breathing disorders, and psychologic factors, which may precipitate or maintain the occurrence of the episodes and also influence their severity.

The more dramatic forms of arousal disorder, especially, may be interpreted by parents as a sign of psychiatric disorder, which is rarely correct. All arousal disorders can be socially disadvantageous, however, especially when they occur away from home, and this can cause emotional upset.

Types of arousal disorder: confusional arousals, sleepwalking, and sleep terrors

Three main forms of arousal disorder have been described, although episodes may combine elements of all three. Sleepwalking and sleep terrors are well known; confusional arousals are generally less well recognized. Clinically, all have in common a curious combination of features suggestive of being simultaneously awake and asleep. Despite seeming to be alert (indeed, sometimes highly aroused), the child seems confused and disoriented and relatively unresponsive to environmental events including parents' attempts to communicate. There is little or (usually) no recall of events during each episode of disturbed behavior. The child might display a sequence of confusional arousals in early childhood, sleepwalking later, followed by sleep terrors in late childhood and adolescence. Alternatively, elements of all three forms can occur at any one stage of development. Similarly, the family history of arousal disorder can take a variety of forms.

Confusional arousals occur mainly in infants and toddlers, most of whom may have such episodes to some extent. Their features (especially the degree of behavioral disturbance) have something in common with sleep terrors, although the degree of disturbance tends to be less intense. An episode may begin with movements and moaning and then progress to agitated and confused behavior with crying (perhaps intense), calling out, or thrashing about. Typically, although seeming to be very alert, the child does not respond when spoken to; more forceful attempts to intervene may meet with resistance and increased agitation.

Parents often are very alarmed and, wanting to console the child, may make vigorous attempts to waken him or her, without success or only with much trying. Such efforts actually may prolong the arousal, and the child, if awakened to some extent, is likely to be confused and frightened. Each episode usually lasts 5 to 15 minutes (possibly much longer) before the child calms down spontaneously and returns to restful sleep.

Sleepwalking (somnambulism) is said to occur occasionally in 20% to 40% of children and frequently in another 3% to 4%, mainly between 4 and 8 years of age. Episodes, which can last up to 10 minutes or so, are usually less dramatic than confusional arousals. The young child may crawl or walk about in the cot. At a later age, the child may walk calmly around the bedroom or into other parts of the house such as to the toilet, toward a light, or to the parents' bedroom. The child may appear downstairs or may be found standing on the landing or elsewhere in the house, looking vague, with eyes open but with a glassy stare. At most, the child will be partially responsive. Some children are found asleep in various parts of the house. Quite complicated routes may be followed if they are well known to the child, or other complex habitual behavior (automatism) may occur, possibly extending over long periods of time. Movements are often clumsy, and urinating in inappropriate places or other inappropriate behavior is common.

Accidental injury in sleepwalking (eg, from falling downstairs) is a serious risk. In later childhood or adolescence, the wandering may extend further within the house or outside of it. At this age and later, the sleepwalking may take an agitated form (similar to sleep terrors). Attempts to intervene may worsen the agitation and increase the risk of injury from crashing through windows or glass doors, for example. Rarely, it seems, the child's behavior results in injury to someone else [16].

Sleep terrors (pavor nocturnus) are better called "sleep terrors" because they are associated with sleep, whatever its timing. They occur in about 3% of children, mainly in later childhood.

Classically, parents are woken by the child's piercing scream, which marks the very sudden

onset of the partial arousal. The child appears terrified, with staring eyes, intense sweating, rapid pulse, and cries or other vocalizations suggesting intense distress. The child may jump out of bed and rush about frantically, as if trying to escape from something. Injury from running into furniture or jumping through windows is again a serious risk. Other people also may be injured in the process. The event usually lasts no more than a few minutes at most. Typically it ends abruptly, and the child settles back to sleep. If he wakes up at the end of the episode, the child may describe feelings of primitive threat or danger, but not the extended narrative of a nightmare.

If a detailed description is obtained, special investigations usually are not necessary for the recognition of arousal disorders. PSG (extended to include additional physiologic parameters beyond basic measures together with audiovisual monitoring) during episodes might be helpful if, despite careful clinical evaluation, the distinction still cannot be made between arousals and the other parasomnias that involve complicated behavior at night. Perhaps the most usual diagnostic confusions concern the differences between arousal disorders, nightmares, and nocturnal seizures. Their main comparative features are shown in Table 1.

There are a number of important principles regarding the management of childhood arousal disorders.

- **Parents' anxiety is usually lessened by explanation with reassurance (when justified) that these often dramatic and frightening events do not mean that the child is ill or disordered and that the child usually can be expected to grow out of them by later childhood or adolescence.**
- **Regular and adequate sleep routines to prevent loss or disruption of sleep resulting in an increased amount of slow-wave sleep are important, as is avoidance of other known precipitating factors.**
- **The environment should be made as safe as possible to reduce the risk of injury (eg, remove obstructions in the bedroom, secure windows, install locks or alarms on outside doors, or cover windows with heavy curtains).**
- **Parents should be encouraged to refrain from trying to waken or restrain the child during the episode. As mentioned, waking the child is difficult, counterproductive (the child will be confused and frightened if awakened forcefully), and unnecessary. It is**

Table 1: **Comparison of main features of partial arousals, nightmares and nocturnal seizures**

Characteristic	Arousal disorder	Nightmares	Nocturnal seizures[a]
Time of the night	Usually first third of the night	Middle to last third of the night	Variable
Usual stage of sleep	Deep NREM	REM	Variable
Behavior	Variable but usually dramatic with intense autonomic arousal (apart from calm sleepwalking); often inaccessible and cannot be comforted; may resist intervention	Little movement during dreams but distressed on awakening, accessible and welcomes comforting. Mild autonomic arousal	Variable; may be undirected violence or distress during or after attack in state of impaired consciousness
Level of consciousness	Unaware during episode, confused if awakened or following episode	Asleep during episode, fully awake afterwards	Variable, often impaired during or after attack
Likelihood of injury	Moderate to high in agitated sleepwalking and sleep terrors	Low	Overall low to moderate
Memory for events	None or fragmentary	Vivid recall	Variable
Family history	Common	None	Variable
Prevalence	Common	Common	Much less common

Abbreviations: NREM, non–rapid eye movement; REM, rapid eye movement.
[a] In view of the wide range of types of epileptic seizures associated with sleep, the descriptions given are only generalizations with certain clear exceptions to the general rule (see text).

much better to wait until the episode subsides and calmly help the child back to bed.

- **If, as is usually the case, the child has no recall of the episodes, there is little point in telling the child about them, because they this may become a source of anxiety.**
- **If sleepwalking or sleep-terror episodes are frequent and consistent in their time of occurrence, scheduled awakening can be helpful. This process consists of the child being awakened gently and briefly 15 to 30 minutes before the episode is likely. The procedure is repeated nightly for up to a month. Preliminary reports suggest that improvement can be maintained for at least several months. It has been suggested, however, that this form of treatment sometimes causes such loss of sleep that the arousal disorder becomes more severe.**
- **Medication should be reserved for particularly worrying, embarrassing, or dangerous arousals where other measures have failed. Benzodiazepines (such as low-dose clonazepam) and tricyclic drugs (eg, imipramine) have been used but with mixed results. There is some evidence that selective serotonin reuptake inhibitors might be effective. Use of benzodiazepines is best restricted to several weeks at most to avoid possible hazards of long-term use (eg, tolerance, adverse effects, and abuse), although reassuring findings about such risks have been reported in adults for whom extended use has seemed justified because of the serious nature of their arousal disorders or other parasomnias.**
- **If there is evidence of an underlying psychologic problem, appropriate enquiries and help are indicated.**

Primary parasomnias associated with rapid eye movement sleep

Nightmares

These frightening dreams are an obvious example of an REM (or "dreaming") sleep-related parasomnia. Unfortunately, the term "nightmare" is sometimes used mistakenly for any type of recurrent dramatic nighttime episode.

True nightmares, which typically occur in the later part of overnight sleep when REM sleep is most abundant, are said to occur in up to 75% of children from early childhood onwards; persistent nightmares may occur in as many as 30% to 40%. Their content varies with age, tending to become increasingly complex (ie, monsters or other frightening creatures at an early age, progressing to dreams based on frightening television or film content or events at home or school). Typically, the child wakes up, very frightened and fully alert, and describes having just had a frightening, vividly recalled sequence of dream events (ie, a narrative), often involving the child himself. He remains afraid after waking up and cannot get back to sleep for some time, although it is usually possible to reassure and comfort him.

Generally, such dreams occur infrequently without any serious psychologic significance. They may be spontaneous or (like partial arousals) precipitated by illness or psychologic stress of any sort. Especially frequent nightmares may be a prominent feature of an anxiety disorder including posttraumatic stress disorder, and their content, especially if consistent, may be revealing about the nature of the traumatic experience (eg, child abuse). In such circumstances, nightmares may coexist with bedtime fears. Nightmares also can be symptomatic of other serious psychiatric conditions. The many medications whose use (mainly in adults) is associated with the occurrence of nightmares include various treatments for cardiovascular disease. Abrupt withdrawal from REM-suppressing substances (including most antidepressants, benzodiazepines, methylphenidate, and alcohol) also can precipitate nightmares because of a REM sleep rebound effect later in the night. The same rebound effect may result from lack of sleep.

Occasional nightmares require no special measures apart from comforting the child at the time they occur. Preventive measures include avoidance of disturbing stories or videos before going to bed and avoiding other sources of overarousal or distress. Other measures that might be helpful in severe cases include systematically helping the child to be less concerned about the frightening content of the nightmare or rehearsing the content but with a modified, less alarming ending. In even more complicated cases, treatment, including the use of various forms of psychotherapy, is directed at the underlying cause.

Rapid eye movement sleep behavior disorder

REM sleep behavior disorder (RBD) is a relatively newly described parasomnia [17]. It initially was thought to be confined to elderly men, but recent reports indicate that it (or a similar disorder) can occur in other groups, including women and children. It is characterized by an abnormal preservation of muscle tone during REM sleep that allows dreams to be acted out. If the dreams are vivid and violent, the patient punches, kicks, leaps, or runs about, often causing self-injury or injury to anyone nearby. Typically, such episodes occur in the first REM sleep period about 90 minutes after going to sleep.

In adults, RBD often is associated with neurodegenerative disease and narcolepsy. Recent reports also suggest a link with many other neurologic disorders in both adults and children. What initially might be considered an idiopathic form of RBD may well, in fact, be the early sign of a neurodegenerative disorder; the lesser forms of motor dysfunction during REM sleep (such as gross twitching or jerking, especially if accompanied by sleep talking or loud vocalizations) can be even earlier signs. An acute form has been described in adults associated with the use of various antidepressant drugs or the misuse of or withdrawal from REM-suppressing agents such as alcohol, amphetamines, or cocaine. A major stress seems to trigger the onset of the condition in some cases.

Because of its strong associations with organic factors, RBD often can be considered one of the secondary parasomnias (see later discussion), and the term "cryptogenic" RBD is increasingly preferred to "idiopathic."

Diagnosis rests on a combination of sleep-related injury or disruptive behavior with evidence from audiovisual/PSG monitoring of increased muscle tone or phasic muscle twitching in REM sleep, prominent movements or vigorous jerking, often with intense vocalizations, in REM sleep, and recall of corresponding dream content on waking. Clonazepam is an effective treatment in most cases.

RBD is of forensic importance as a possible cause of sleep-related violence. Although there are relatively few reports of RBD (or something similar) in children, it should be considered as a possible explanation of dramatic nocturnal behavior.

Primary parasomnias associated with awakening

The two main parasomnias experienced at awakening are hypnopompic hallucinations and sleep paralysis, both of which were described earlier as examples of parasomnias that can occur at the onset of sleep.

Primary parasomnias inconsistently related to phase of sleep

Sleep talking

Sleep talking is common and occurs in all sleep stages. It occurs as an isolated phenomenon but also can be a feature of a variety of other sleep disorders, such as arousal disorders, OSA, or RBD. Sleep talking usually is spontaneous but may occur in response to conversation. It usually is brief and inconsequential, but sometimes it extends to long speeches, possibly emotional in tone. At times it consists mainly of moaning noises (as distinct from the separate condition of expiratory groaning). By itself, sleep talking is of no clinical significance apart from the annoyance caused to others trying to sleep nearby. Treatment is difficult to specify unless there is a particular underlying sleep disorder.

Nocturnal enuresis

Nocturnal enuresis (bedwetting) is a particularly common problem in children [18]. Its diagnosis implies recurrent involuntary bedwetting in the absence of a physical cause in a child over the age of 5 years. Bedwetting at least once a week occurs in about 5% of 7-year-olds and 3% of 9-year-olds. Around 2% are still affected at age 11 years, and perhaps 1% are affected at age 14 years or older. Boys outnumber girls increasingly as childhood advances. Children are said to have primary enuresis if they have never achieved normal bladder control (accounting for 70% to 90% of cases); secondary enuresis means loss of control after acquiring it for at least 6 months.

The possible causes or associated factors that have been described are a maturational delay (often shared by other family members), limited functional bladder capacity or bladder instability, parental failure to toilet-train the child satisfactorily, overall developmental delay, behavioral disturbance, social disadvantage, and stressful experiences of any type (psychologic factors seem to be more relevant in the development of secondary enuresis).

Nocturnal enuresis can result in embarrassment and upset for the child (restricting social activities away from home) and annoyance and even punitive behavior on the part of parents.

Enuresis tends to happen early in sleep but can occur in any stage of sleep. By means of careful history taking, physical examination, and urinalysis, enuresis should be distinguished from organic causes of bedwetting including urinary tract infection (especially in girls), structural abnormalities of the urinary tract, diabetes insipidus, and neurologic conditions (including epilepsy) in which bedwetting (and possibly also wetting by day) are liable to occur. Because it may be associated with OSA, for example, a complete sleep history should be taken.

Fluid restriction before bedtime or waking the child to go to the toilet before the parents go to bed have been used as treatment strategies but often are of little help. Behavioral approaches such as rewards for dry nights seem to be more helpful than recriminations when the child wets the bed. Conditioning by means of an alarm system is reported to be effective in a high proportion of cases if

attempted in a systematic, consistent, and determined way, including overlearning beyond the initial positive response. The relapse rate is said to be relatively low. Medications in the form of desmopressin and low-dose tricyclic antidepressants (eg, imipramine) are said to be effective second-line treatments but with a high relapse rate when withdrawn. Because of the potential cardiotoxic effects of the tricyclic drugs, desmopressin is often preferred for short-term use or for special circumstances (eg, when staying with friends for a brief period). Bladder training to increase bladder capacity and stability is another measure that has been used. Psychiatrichelp should be provided in the few cases where this is appropriate.

Secondary parasomnias

It is important for clinicians in all specialties to be aware of the sleep-related manifestations of many medical and psychiatric disorders (Box 2).

Parasomnias of physical origin: sleep-related epilepsies

Sleep disorders, especially the parasomnias, can be confused with epilepsy, and vice versa [19]. These mistakes are important because the significance of epilepsy is very different from other parasomnias in terms of underlying cause, the need for special investigations, the type of treatment required, and ultimate prognosis.

Few generalizations about "epilepsy" are justified because the term covers such a wide range of conditions that differ in their cause, manifestations, effects, treatment needs, and natural history. This diversity is reflected in those epilepsies in which seizures occur at night. The varied clinical manifestations of nocturnal seizures make it difficult to generalize about the features that distinguish such seizures from other parasomnias.

A number of types of epilepsy are closely related to the sleep-wake cycle [20]. Among them are the following, which can readily be confused with nonepileptic parasomnias.

Benign partial epilepsy with centrotemporal spikes (Rolandic epilepsy) is a common form of childhood epilepsy in which about 75% of patients have seizures exclusively during sleep. The oropharyngeal motor, sensory, and autonomic symptoms of this form of epilepsy, often with preservation of consciousness, can be very distressing to the child, giving rise to disturbed behavior. The seizures occur on falling asleep, in the middle of the night, or (perhaps mainly) shortly before or on waking. Diagnosis rests mainly on the clinical characteristics of the episodes, but interictal centrotemporal spikes with normal background EEG activity are an important confirmatory finding.

Nocturnal frontal lobe epilepsy, described in both adults and in children [21], often is misdiagnosed mainly because the complicated motor manifestations (eg, kicking, hitting, rocking, thrashing and cycling, or scissor movements of the legs) and vocalizations (ranging from grunting, coughing, muttering, or moaning to shouting, screaming, or roaring) that characterize many attacks are very different from other seizure types. The abrupt onset and termination, short duration of the attacks (different from seizures of temporal lobe origin), and, sometimes, preservation of consciousness also can suggest a nonepileptic basis for the attacks. Furthermore, the overall manifestations can take a variety of forms [22]. Diagnosis rests on awareness of this form of epilepsy and recognition of these clinical features. EEG recordings even during the episodes are of limited diagnostic value. The underlying cerebral pathology varies, and often no structural abnormality is found. One form is clearly genetic in origin with an autosomal dominant pattern. Response to treatment seems very variable.

The manifestation of **seizures of temporal lobe origin** may well have features in common with some of the more dramatic types of primary parasomnias, at least in older children. This resemblance includes seizures that have pronounced affective symptoms, especially fear.

Fear also is prominent in **benign epilepsy with affective symptoms** in which nocturnal seizures usually occur soon after falling asleep.

In **benign occipital epilepsy** the seizures themselves (which may involve complex visual experiences including hallucinations and illusions) and the child's reactions can involve dramatic behavior. A mainly nocturnal form with early onset (mainly around the age of 5 years) has been described.

The distinction between epilepsy and other parasomnias (and, indeed, between the various types of nocturnal seizures) should be possible in most cases by careful clinical evaluation combined with

Box 2: The main secondary parasomnias

Physical origin
Nocturnal epilepsies
Respiratory disorders
Other

Psychiatric origin
Posttraumatic stress disorder
Nocturnal panic attacks
Sleep-related eating disorders
Dissociative states
Other psychogenic states

the appropriate special investigations. As emphasized previously, the main requirement is as detailed a clinical account as possible. Special investigations include sleep studies and long-term EEG monitoring by various means such as combined audiovideo/EEG monitoring or home EEG monitoring, which generally is more acceptable to children. The occurrence of attacks both at night and during the day favors epilepsy. The diagnosis may remain difficult, however, because of the variable clinical manifestations and EEG accompaniments of some seizures.

Various diagnostic complexities concerning nocturnal seizures and other sleep disorders have been reported. In adults, epilepsy has been misdiagnosed as sleep apnea when seizures have involved awakenings with feelings of choking, abnormal movements, and excessive daytime sleepiness. Also OSA can be a cause of anoxic seizures, and seizures of primarily cerebral origin may be exacerbated by a concomitant sleep disorder; for example, seizures in children have been reported to improve with treatment of sleep apnea. The possible confusion between repetitive sleep starts in some disabled children and epilepsy was mentioned previously.

Epilepsy during sleep may be simulated by patients who are actually awake [23]. The demonstration of this by careful monitoring clearly calls for investigation of the motive for such behavior.

Other parasomnias of physical origin

Other parasomnias of physical origin in children include headaches of a migrainous type, fearful awakenings caused by respiratory disorders such as asthma or sleep apnea, gastrointestinal conditions (notably gastroesophageal reflux and diffuse esophageal spasm), and RLS and PLMS (both of which can be symptomatic of an underlying physical illness). Also, as described previously, RBD may be secondary to neurologic disease or medication.

Parasomnias secondary to psychiatric disorders

The clinical manifestations of certain primary psychiatric disorders include episodic disturbances of behavior or experience that call for psychiatric help rather than attention to the sleep disorder alone.

Nightmares are acknowledged to be a prominent feature of **posttraumatic stress disorder**, which is associated with a wide variety of traumatic experiences in childhood [24]. Other dramatic parasomnias in adults do not seem to fit into conventional categories, however, and excessive daytime sleepiness may also be a feature of this disorder. The same seems to be true of children.

Nocturnal panic attacks in children and adolescents may not be recognized as such because of the features they share with other causes of apparently fearful behavior at night, such as nightmares, night terrors, OSA awakenings, and partial seizures [25].

Panic attacks are characterized by a sudden awakening in a highly aroused state with dizziness, choking, sweating, trembling, palpitations, and other distressing sensations including an intense fear of impending doom (ie, of dying). Such episodes may or may not also occur during the day with other phobic symptoms. Differential diagnosis requires careful clinical evaluation rather than PSG. Panic attacks may coexist with other parasomnias including arousal disorders.

Experience with adults suggests that general anxiety-reducing methods are helpful, as are behavioral treatment and medication in the form of antidepressants or benzodiazepines.

Sleep-related eating disorders can be associated with daytime psychiatric disorders, but they may be linked with a number of other sleep disorders, as discussed below.

In **dissociative states** (ie, states considered to be characterized by impaired awareness for psychologic reasons), dramatic behavior, sometimes bizarre or violent, can be enacted at night but while the patient actually is awake as shown by PSG [26]. The nocturnal episodes of some patients diagnosed as having the condition began in later childhood or adolescence and sometimes are thought to involve re-enactment of previous experiences of physical or sexual abuse. Such "pseudoparasomnias" need to be distinguished from other dramatic parasomnias and, of course, from malingering.

Other complex parasomnias

Some parasomnias seem to combine elements from the different categories just described.

Sleep-related eating disorders illustrate how strange behavior at night can be a feature of various underlying sleep disorders [27]. Mainly a problem in adult women, the often bizarre eating practices at night may begin in childhood. The association with daytime eating disorder is debated, some claiming that it often is overlooked in those who have a daytime eating problem. The behavior is linked mainly to sleepwalking but also may occur in people who have OSA, RLS, narcolepsy, or other causes of disrupted sleep. Treatment is that of the underlying sleep disorder.

A **parasomnia overlap disorder** has been reported in patients of various ages (including children and adolescents) exhibiting clinical and PSG features of sleepwalking, sleep terrors, and RBD [28]. Some patients had physical or psychiatric

disorders; in others the condition seemed to be idiopathic.

Essentials of clinical assessment

The cornerstone of the recognition and correct diagnosis of the parasomnias is careful clinical evaluation, which, in most cases, will be sufficient without the need for special investigations. Failure to conduct adequate clinical appraisal probably accounts for most misinterpretations or omissions. The following points represent the minimal enquiries that need to be made.

1. The first and most basic question about any child (presenting with a sleep problem or with any other complaint) is, "Does the child have any unusual behaviors or experiences at night?" Possibilities include
   - **Strange sensations**
   - **Talking, shouting, moaning, or screaming**
   - **Waking up frightened**
   - **Wandering or rushing about**
   - **Hurting himself**
   - **Rhythmic movements or noises**
   - **Jerking movements**
   - **Difficulty breathing**
   - **Wetting the bed**
2. Aspects to be considered in describing the episodes are
   - **Timing (eg, early in sleep suggests an arousal disorder; late in sleep indicates an REM-related parasomnia)**
   - **Frequency**
   - **Duration**
   - **Physical or psychologic components (eg, degree of autonomic arousal)**
   - **Level of consciousness**
   - **Recall**
   - **Precipitating or ameliorating factors**
3. Ideally, precise details are required of the sequence of subjective and objective features of the episodes from the first change to resolution and the circumstances in which they occur. Home audiovideo recordings can be helpful, often revealing aspects that are lost in retrospective descriptions.
4. Further questions that need to be considered are
   - **Were any physical or psychologic factors consistently associated with the first of the episodes and their subsequent occurrence?**
   - **Have there been any comparable episodes during daytime sleep?**
   - **Does the child have more than one type of parasomnia?**
   - **Is there reason to suspect that the parasomnias are manifestations of a physical or psychiatric disorder, or some other sleep disorder?**
   - **Does the child have one or more sleep disorders separate from the parasomnias?**

This basic account should be followed by further assessments [29] principally in the form of

- **A full sleep history**
- **Review of the child's developmental history (physical and psychologic)**
- **Family history**
- **Physical and mental/behavioral state examination**

The findings from these inquiries will indicate the need, if any, for special investigations, such as sleep studies or referral to a sleep disorders clinic.

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