Sleep violence

Violence during sleep is more common than is usually thought and has characteristic clinical features. These reflect the altered cerebral activity during sleep as well as the specific pathophysiology of the underlying sleep disorder. There are often forensic as well as clinical implications of violence during sleep which need careful assessment.

Sleep is characterized by a state of reduced awareness and responsiveness to both internal and external stimuli so it is often thought surprising that complex activities, including violent behaviours, can arise from sleep. However, sleep is not a passive process but a state in which the activity of the brain is maintained in a different form to wakefulness. The two main states of sleep, non-rapid eye movement (non-REM) and rapid eye movement (REM) sleep, also have very different features and different organizations of motor activity.

In non-REM sleep, the cerebral cortex is temporarily functionally disconnected from the brainstem and spinal cord so that reflex mechanisms predominate. In REM sleep, however, the cerebral cortex is active and interacts particularly with the pons but also other areas of the brainstem and spinal cord. The lower motor neurones and almost all of the skeletal muscles are intensely inhibited so that activity in the cortex basal ganglia and other centres is not physically expressed (*Table 1*).

Motor activity can nevertheless break through in both non-REM and REM sleep in certain situations. Occasionally these movements may lead to self injury or accidental injuries to the bed partner, but there are also a variety of conditions in which the sleeper's behaviour shows violence specifically directed at an individual.

Clinical features of sleep violence

Violence during sleep needs to be distinguished from similar activities carried out at night while the subject may appear to be asleep but is actually awake. He or she may subsequently deny any recall of the episode. The activities may be carried out while the person is awake but intoxicated with alcohol or under the influence of other psychoactive drugs and recall may only be partial.

Table 1. Features of non-rapid eye movement and rapid eye movement sleep

	Non-rapid eye movement sleep	Rapid eye movement sleep
Cortical activity	Global disconnection	Selective dreams
Somatic reflexes	Reduced	Absent
		Irregular twitches
Autonomic function	Parasympathetic ++	Variable
Metabolic rate	Reduced	Variable

Dr John M Shneerson *is Director of the Respiratory Support and Sleep Centre at Papworth Hospital, Cambridge CB23 3RE*

In addition, violence while awake may occur in psychogenic dissociative disorders (Agargum et al, 2002). These usually occur in those who have suffered childhood abuse and the violent activities may re-enact these behaviour patterns. Occasionally the subject may wander from the bed to carry out the violence. The episodes occur around 30–90 seconds after waking, but during this interval the appearance is of being asleep and afterwards there is denial of any recall of the event.

Violence during sleep has characteristic features in keeping with an activity that does not involve awareness or the conscious state:

- A lack of motive for the attack with no potential gain from the violence
- No previous personal animosity – the violence is often directed at the sleeper's life partner or child if they are sleeping close by
- There are no signs of premeditation of the attack
- The sleeper is unresponsive to the situation and even to intense stimuli resulting from the violence
- Complete amnesia of the event, although in some situations the aggressor may regain awareness towards the end of the episode and have some recall
- Surprise, remorse or guilt afterwards in keeping with the lack of awareness of the episode
- No attempt is made to conceal the evidence about the event. When a serious injury has occurred, the sleeper often self reports the episode to the police or other authority or takes the injured person to hospital
- The event is usually also out of character for the subject but violence during sleep can be carried out by people who are also violent while they are awake.

Causes of sleep violence

Violent attacks during sleep can occur with both non-REM and REM sleep disorders (*Table 2*). The most common conditions are:

Non-REM sleep arousal disorders

These include the spectrum of conditions conventionally known as confusional arousals, sleepwalking and sleep terrors. Sleepwalking is common in children and in around 20% it continues to occur in adults, comprising 1–2% of the adult population. Violence is rare in these conditions in children and in adults it is much more common in males than females.

In a confusional arousal there is only partial awareness of the surroundings and no specific features of sleepwalking or sleep terrors. The subject may misinterpret the environ-

ment and, for instance, regard restraint by the bed partner as requiring self defence, with violent consequences.

In sleepwalking, the subject characteristically gets out of bed, stands, walks or runs and carries out complex activities that may include going downstairs, opening the front door or even driving a motor vehicle. Self injury within the house or from climbing through windows is well recognized and while the subject usually allows him- or herself to be put back to bed without resistance, an attempt at restraint often leads to a confusional arousal with a sudden act of violence (Schenck et al, 1995).

Sleep terrors are characterized by an initial gasp or scream and signs of intense autonomic activity such as fear, panic, sweating, dilated pupils, rapid respiratory and heart rates, increased muscle tone and often frenetic activity. There may be a sensation of intense fear as if the subject is coming out of a faint or a frightening situation.

Arousal disorders occur as a result of an incomplete transition to wakefulness from the deeper stages of non-REM sleep (stages 3 and 4). The reasons for this are poorly understood, but there are probably a variety of factors:

- Although the duration and timing of non-REM sleep in subjects with arousal disorders appears normal, there is often an increase in the arousability from this type of sleep, indicated by an increase in the amplitude of the cyclic alternating pattern (Zucconi et al, 1995). The cyclic alternating pattern is a fluctuation in arousability in non-REM sleep that enables the sleeper to respond to the environment but equally may cause unwanted partial or complete awakenings
- Abnormalities in the motor response of the individual to arousal
- Abnormalities in the processing of sensory information. Changes in the electroencephalogram (EEG) and evoked potentials have been demonstrated
- Abnormalities of emotional processing. The thalamocingulate pathways, which are involved in emotional processing, become active in sleepwalking (Bassetti et al, 2000). The rest of the cortex remains inactivated, including the prefrontal cortex, so that awareness of the episode is absent or nearly absent.

The clinical correlates of these physiological abnormalities are that violence resulting from an arousal disorder usually occurs towards the end of the first sleep cycle when non-REM sleep is at its deepest. This is usually 60–90 minutes after the onset of sleep.

The characteristic sensory abnormalities during arousal disorders, including sleep violence, include a loss of facial recognition despite maintenance of spatial awareness (Yellowlees, 1878). The subject's eyes remain open during the episode, but failure to recognize the victim is a feature. The aggressor may be able to tolerate pain and severe injuries without any awareness (Poldosky, 1959).

Sleep violence may represent release from inhibition by higher centres of innate behavioural patterns. The violence may comprise punching, kicking or strangling the victim, or the victim may be battered, knifed or shot. The victim is almost always the bed partner or is sleeping nearby unless the episode occurs in a confusional arousal at the end of an episode of sleepwalking. This is usually associated with the aggressor being restrained by the victim and then reacting with violence (Broughton et al, 1993).

Violence as a result of non-REM sleep arousal disorders is not associated with the type of narrative dreams that are characteristic of REM sleep, but there may be recall of frightening faces, animals such as snakes or spiders, or of impending death. After the episode the subject may appear confused for a short while.

When violence occurs as part of an arousal disorder, there is usually a history of this type of episode as a child or a family history of similar events (Ohayon et al, 1997). There is no specific psychopathology, although there is often excessive inhibition of aggressive feelings. Episodes are often triggered by specific factors, the most important of which is sleep deprivation. This leads to a rebound increase in non-REM sleep which, in a susceptible subject, increases the opportunity for a violent episode to occur. 'Stress' acts through unknown mechanisms possibly by increasing the tendency to arouse from sleep. Alcohol consumption has been thought to trigger these episodes as may drugs such as zolpidem, chlorpromazine, paroxetine, amitriptyline, ciprofloxacin and propranolol (Luchins et al, 1978; Scott, 1988). Any factor that fragments sleep, such as obstructive sleep apnoeas and periodic limb movements as part of the restless legs syndrome, also causes arousal disorders and sleep violence.

The investigation of sleep violence resulting from arousal disorders is unsatisfactory. Complex sleep studies (polysomnography), in which the sleep state as well as the electromyogram, video and audio are recorded, are often normal (Cartwright, 2000). They are useful in excluding other causes of sleep violence and may show features of sleep apnoeas or periodic limb movements. Polysomnography may show abnormalities such as fragmented sleep (Espa et al, 2000), hypersynchronous delta activity before the event (Pilon et al, 2006) and unstable EEG patterns afterwards indicating a transient mixed sleep/wake state (Schenck et al, 1998). Home video recordings may give information about the nature of the violent behaviour, but not of the stage of sleep in which it arises.

The principles of treatment of sleep violence resulting from an arousal disorder are:

Table 2. Causes of sleep violence

Non-rapid eye movement sleep disorders	Arousal disorders
	Post-traumatic stress disorder
	Obstructive sleep apnoeas
	Epilepsy
Rapid eye movement sleep disorders	Rapid eye movement sleep behaviour disorder
	Status dissociatus
	Narcolepsy

- Explanation of the nature of the events to the aggressor and others concerned
- Avoidance of sleep deprivation and any drugs that may be triggering the episodes
- Treatment of any underlying sleep disorders such as obstructive sleep apnoea or restless legs syndrome
- Advising avoidance of stress and stress management
- Use of medication. There are no clinical trials of medication for this type of sleep violence but benzodiazepines such as clonazepam are effective in sleepwalking and sleep terrors and selective serotonin-reuptake inhibitor (SSRI) antidepressants may help, although they can also trigger these events
- Recommending protection. This may be as simple as sleeping in a different bedroom. Sensors that alarm when the aggressor walks through a door or locking the door may help, especially if violence occurs in a confusional arousal at the end of a sleepwalking episode.

REM sleep behaviour disorder

Unlike non-REM sleep arousal disorders, REM sleep behaviour disorder almost invariably occurs in older adults, particularly over the age of 55 years. About 90% of patients are male and if it does occur in younger people, it is usually acute and caused by either drug intoxication or acute withdrawal of REM sleep suppressant drugs (e.g. amphetamines and related drugs and antidepressants), which leads to REM sleep rebound.

About 70% of older subjects with REM sleep behaviour disorder develop a Parkinsonian syndrome including Lewy body disease, within around 15 years (Boeve et al, 1998), but even if Parkinsonism is already present, the subject may still be able to commit vigorous violent activities while asleep (Comella et al, 1998).

The characteristic feature of REM sleep behaviour disorder is retention of muscle activity during REM sleep when it is normally inhibited. Initially this may simply be irregular jerky movements of the limbs or kicking, but, as it progresses, more complex organized actions appear including flailing of the arms, pointing the fingers or hands at a perceived person or animal, punching, laughing, talking, shouting, and directing injurious actions towards the bed partner. There is often a vivid, intense dream with a violent content, which usually involves being threatened or confronted by unfamiliar people or animals, leading the subject to react by attempting to flee or to fight back. There is a close link between the type of activity performed and dream content. The dreams are often repetitive and, since there are around four to five cycles of REM sleep each night, there may also be this number of bouts of violent activity.

The diagnosis should be suspected from the age and sex of the subject, the partner's description of the activities and the aggressor's description of the dreams, although there may be little recall of these. The diagnosis can be confirmed by polysomnography which shows retention of muscle tone during REM sleep when it should normally be absent. It may also show the type of physical activity carried out in the home.

Any cause of REM sleep behaviour disorder should be addressed and if obstructive sleep apnoeas are present, it may be worth treating these. When they cause frequent arousals from REM sleep, resulting in confusional episodes, the clinical picture may be identical to REM sleep behaviour disorder (Iranzo and Santamaria, 2005). Around 90% of subjects respond to a benzodiazepine, e.g. clonazepam 0.5–2 mg nightly, but shorter acting drugs such as zopiclone 3.75–7.5 mg taken nightly may also be effective. Melatonin up to 15 mg nightly may also be of help.

It is important to take steps to protect both the patient and the partner. Any implement that could be used aggressively should be removed from the sleeping area, but physical restraint should be avoided.

Status dissociatus

In this condition the states of non-REM and REM sleep and wakefulness become indistinguishable. Status dissociatus is usually caused by neurodegenerative disorders, e.g. multisystem atrophy. The clinical picture is similar to REM sleep behaviour disorder. Clonazepam is often effective.

Narcolepsy

Violence during sleep in narcolepsy is rare, but may occur during hypnagogic hallucinations (pre-sleep dreams) if the subject perceives a threat and misinterprets the bed partner as the aggressor (Zorick et al, 1979; Szucs et al, 2003). Several cases have reported patients who have killed people either in the same room or next door when shooting at a hypnagogic hallucination.

Epilepsy

Nocturnal epilepsy is most common early in the night particularly in stage II non-REM sleep. Violence during seizures is uncommon (Borum et al, 1996), but may occur with nocturnal frontal lobe seizures. These often lead to complex and aggressive behaviour, but the activity is rarely directed towards the bed partner who is more commonly accidentally injured. Violence during temporal lobe epilepsy is rare in sleep but can occur in post-ictal states when there is reduced awareness of the environment.

Post-traumatic stress disorder

Post-traumatic stress disorder may follow either a military or civilian traumatic event and is characterized by repetitive re-experiencing of this either through intrusive thoughts (flashbacks) or in 'nightmares'. These may occur either in non-REM or REM sleep. The content reflects the traumatic event and the subject may waken suddenly from the nightmare and carry out violent actions.

The diagnosis is usually clinical but polysomnography may help. Both behavioural therapy and psychotherapy may be of benefit often combined with SSRI antidepressants; prazosin is also effective in treating the nightmares and their behavioural responses.

Forensic aspects

Sleep violence is almost certainly more common than is recognized but for many reasons only a minority of episodes come to either medical attention or lead to criminal allegations (Cartwright, 2004; Mahowald et al, 2005). English law requires that to be found guilty it should be demonstrated that the defendant carried out the act, and also had conscious knowledge of what was being done (Thomas, 1997). If it can be shown that the action was an 'automatism', he or she will not be convicted.

An automatism is a behaviour that is involuntary and of which the subject has no awareness (Mahowald et al, 2000). Reduced awareness of the action is not sufficient to fulfil the criteria for an automatism. Lack of memory of the episode is not equivalent to an automatism and neither is the inability to control the impulse to carry out the act of violence. A 'sane' automatism is one in which there is a trigger for the actions that is external to the subject and is not caused by any disease of the mind. Conversely an 'insane' automatism implies an internal cause with the legal implication that the violence is more likely to recur than if it were the result of an external event. Sentencing is likely to be different according to whether a verdict of sane or insane automatism is found.

The probability of any violence during sleep requires detailed assessment of each step of the account of the events and evaluation of the prior probability of the causes of violence, taking into account medical and family history.

Conclusions

Recognition of cerebral activity during sleep underlies the understanding of sleep violence. In non-REM sleep this primarily reflects loss of higher centre inhibition of brainstem and spinal cord generators of innate behavioural patterns. In REM sleep the loss of motor inhibition enabling physical enactment of dreams allows violence to occur.

The commonest cause in younger subjects is a non-REM sleep arousal disorder related to the confusional arousal, sleepwalking and sleep terror spectrum. These episodes usually occur 60–90 minutes after sleep onset and the violent behaviour is associated with characteristic sensory abnormalities and subsequent confusion. REM sleep behaviour disorder is more common in older subjects and is associated with complex, violent dream narratives. After the event the subject is promptly and fully alert.

Investigation often requires polysomnography as well as a clinical assessment. Any trigger factors for the events, especially sleep deprivation or drug or alcohol ingestion, must be addressed as well as giving advice about protection and treatment of the underlying disorder. **BJHM**

Conflict of interest: none.

Agargum MY, Kara H, Ozer OA, Kiran U, Selvi Y, Kiran S (2002) Sleep-related violence, dissociative experiences and childhood traumatic events. *Sleep Hypnosis* **4**: 52–67

Bassetti C, Vella S, Donati F, Wielepp P, Weder B (2000) SPECT during sleepwalking. *Lancet* **356**: 484–5

Boeve BF, Silber MH, Parisi JE (2003) Synucleinopathy pathology and REM sleep behavior disorder plus dementia or parkinsonism. *Neurology* **61**: 40–5

Borum R, Appelbaum KL (1996) Epilepsy, aggression, and criminal responsibility. *Psychiatr Serv* **47**: 762–3

Broughton R, Billings R, Cartwright R et al (1993) Homicidal somnambulism: a case report. *Sleep* **17**: 253–64

Cartwright R (2000) Sleep-related violence: Does the polysomnogram help establish the diagnosis? *Sleep Med* **1**: 331–5

Cartwright R (2004) Sleepwalking violence. A sleep disorder, a legal dilemma, and a psychological challenge. *Am J Psychiatry* **161**: 1149–58

Comella CL, Nardine TM, Diederich NJ, Stebbins GT (1998) Sleep-related violence, injury, and REM sleep behavior disorder in Parkinson's disease. *Neurology* **51**: 526–9

Espa F, Ondze B, Deglise P, Billiard M, Besset A (2000) Sleep architecture, slow wave activity and sleep spindles in adult patients with sleepwalking and sleep terrors. *Clin Neurophysiol* **111**: 929–39

Iranzo A, Santamaria J (2005) Severe obstructive sleep apnea/hypopnea mimicking REM sleep behavior disorder. *Sleep* **28**: 203–6

Luchins DJ, Sherwood PM, Gillin JC, Mendelson WB, Wyatt RJ (1978) Filicide during psychotropic-induced somnambulism: a case report. *Am J Psychiatry* **135**: 1404–5

Mahowald MW, Schenck CH (2000) Parasomnias; sleepwalking and the law. *Sleep Med Rev* **4**: 321–39

Mahowald MW, Schenck CH, Bornemann MAC (2005) Sleep-related violence. *Curr Neurol Neurosci Rep* **5**: 153–8

Ohayon MM Caulet M, Priest RG (1997) Violent behavior during sleep. *J Clin Psychiatry* **58**: 369–76

Pilon M, Zadra A, Joncas S, Montplasir J (2006) Hypersynchronous delta waves and somnambulism: brain topography and effect of sleep deprivation. *Sleep* **29**: 77–84

Poldosky E (1959) Somnambulistic homicide. *Dis Nerv Syst* **20**: 534–6

Schenck CH, Mahowald MW (1995) A polysomnographically documented case of adult somnambulism with long-distance automobile driving and frequent nocturnal violence: parasomnia with continuing danger as a noninsane automatism? *Sleep* **18**(9): 765–72

Schenck CH, Pareja JA, Patterson AL, Mahowald MW (1998) Analysis of polysomnographic events surrounding 252 slow-wave sleep arousals in thirty-eight adults with injurious sleepwalking and sleep terrors. *Clin Neurophysiol* **15**: 159–66

Scott AIF (1988) Attempted strangulation during phenothiazine-induced sleepwalking and night terrors. *Br J Psychiatry* **153**: 692–4

Szucs A, Jansky J, Hollo A, Migleczi G, Halasz P (2003) Misleading hallucinations in unrecognized narcolepsy. *Acta Psychiatrica Scand* **108**: 314–17

Thomas TN (1997) Sleepwalking disorder and mens rea: a review and case report. *J Forensic Sci* **42**: 17–24

Yellowlees D (1878) Homicide by a somnambulist. *J Mental Science* **24**: 451–8

Zorick FJ, Salis PJ, Roth T, Kramer M (1979) Narcolepsy and automatic behavior: a case report. *J Clin Psychiatry* **40**: 194–7

Zucconi M, Oldani A, Ferini-Strambi L, Smirne S (1995) Arousal fluctuations in non-rapid eye movement parasomnia: the role of cyclic alternating pattern as a measure of sleep instability. *Sleep* **12**: 147–54

KEY POINTS

- Sleep violence usually occurs when the normal inhibition of motor activity during sleep is transiently inhibited, and is characterized by lack of motive, amnesia for the event, subsequent remorse and no attempt to conceal the evidence.
- The most common cause of sleep violence is a non-rapid eye movement sleep arousal disorder similar to sleepwalking.
- The arousal disorder is partly genetic but usually triggered by factors such as sleep deprivation, stress or drugs.
- In older subjects the sleep violence is usually caused by rapid eye movement sleep behaviour disorder in which dreams with a violent content are physically enacted.
- Causes of violence while awake such as dissociative disorders and intoxication should be distinguished from true sleep violence.
- Evaluation of criminal allegations requires on a detailed analysis of the events and of whether or not the aggressor was acting in an automatism.