

Sleep-related Violence

Mark W. Mahowald, MD, Carlos H. Schenck, MD,
and Michel A. Cramer Bornemann, MD

Address

Minnesota Regional Sleep Disorders Center, Hennepin County
Medical Center, 701 Park Avenue, Minneapolis, MN 55415, USA.
E-mail: mahow002@umn.edu

Current Neurology and Neuroscience Reports 2005, **5**:153–158
Current Science Inc. ISSN 1528-4042
Copyright © 2005 by Current Science Inc.

Most violent behaviors arise from wakefulness. It is important to realize that violent behaviors that may have forensic science implications can arise from the sleep period. By virtue of the fact that these behaviors arise from sleep, they are executed without conscious awareness, and, therefore, without culpability. The most common underlying conditions arising from sleep are disorders of arousal (sleepwalking and sleep terrors), the rapid eye movement sleep behavior disorder, and nocturnal seizures. In addition, there are a number of psychiatric conditions (dissociative disorders, malingering, and Munchausen syndrome by proxy) that actually arise from periods of wakefulness occurring during the sleep period. The clinical and medico-legal evaluation of such cases is outlined, and should be performed by a multidisciplinary team of experienced sleep medicine practitioners.

*"In all of us, even in good men, there is a lawless, wild-beast nature which peers out in sleep."
Plato - *The Republic**

Introduction

With increasing frequency, sleep medicine practitioners are asked to render opinions regarding legal issues pertaining to violent or injurious behaviors purported to have arisen from sleep. Such acts, if having arisen from sleep without conscious awareness, would constitute an automatism. Recent advances in sleep medicine have made it apparent that some complex behaviors, occasionally violent or injurious with forensic science implications, are exquisitely state dependent, meaning that they arise exclusively, or predominantly, from the sleep period. Violent behaviors arising from the sleep period are far more common than previously thought, being reported by 2% of the adult population [1].

Sleep Violence Clinical Vignette

S.R., a 28-year-old commercial fisherman, claims he was sleepwalking when he killed E.W., his 42-year-old lover and friend's mother, during a trip to Catalina Island in 2001. The couple had been carrying on a long-term affair behind the back of E.W.'s husband when they checked into a quaint hotel for a romantic weekend getaway. After a tranquil day of sightseeing, S.R. inexplicably turned on his lover sometime after midnight. S.R. later testified during the trial that he had fallen asleep that evening and later "awoke" to find his partner's bloody body on the hotel room floor in front of him. He assumed that he had killed her as he recognized the neck wounds as the type that he would inflict on sharks to sever their spinal cords in order to kill them. S.R. then washed his hands, changed his clothes, and walked to a nearby fire station to inform the authorities he had killed his girlfriend while dreaming about fending off an intruder.

A coroner's examination of the victim revealed a wide array of injuries, including the following: 1) an open head injury with skull fractures and deep cuts to the face caused by repeated blunt trauma from a potted plant that had been taken from outside the hotel room; 2) a fractured jaw; 3) deep bruises to the torso and legs; 4) six broken ribs; 5) a dislocated shoulder, elbow, and wrist; 6) puncture wounds to the popliteal fossae caused by a plastic fork; and 7) multiple deep stab wounds to the back of the neck from the victim's own pocketknife. Based on the extent of injuries and the multiple weapons used, a coroner's official stated that the killing "likely took some time" and that she was alive during the infliction of all the injuries.

S.R. admitted to consuming alcohol and cocaine just hours prior to the attack. S.R. did not recall the actual attack and cited no recent discord in their relationship. An investigator testified that hotel patrons reported hearing knocking and a woman's voice at the approximate time of the slaying. Though there was no obvious motive, the Long Beach Superior Court judge ruled that the facts of the case did not fit the crime of manslaughter, whereas the deputy district attorney promoted a conviction for first-degree murder based upon the brutality and premeditated nature of the offense. With the support of a renowned medical sleep expert, the defense rested its case solely on the existence of an acute violent sleepwalking disorder.

S.R.'s parents provided unusual objectivity and clarity throughout their son's trial. Their son's history included a seizure disorder related to a "traumatic birth," a long history of mental health issues including bipolar affective disorder, a volatile temper, and trouble at school. S.R.'s father, a retired naval commander, said that his son was easily angered and often became verbally abusive while growing up. Furthermore, the father noted that his son "would usually punch something... not somebody." The parents also outlined a history of frequent sleepwalking episodes and recalled that S.R. in his youth would often have dreams where "he had a tendency to think that someone was after him and he needed to protect himself." As a result, the parents were compelled when S.R. was 12 years old to "put an alarm in the house... not to detect intruders, but to alert the family" when their son attempted to sleepwalk outside.

On behalf of the prosecution, several of the victim's friends and family members testified that they had long suspected E.W. to be involved in an abusive relationship with S.R. Witnesses remembered seeing E.W. with bruises on her forehead, throat, biceps, and bite marks on her thighs during times of her involvement with S.R. Several witnesses, including E.W.'s husband, told about an incident where S.R. broke through a plate-glass window in E.W.'s apartment with a knife 6 months before her death. The husband, who was separated from his wife at the time, recalls that E.W. had fled their home and that she "called him in a panic." Shortly thereafter, the couple reconciled on their third wedding anniversary. The husband stated that he was not aware that his wife had gone back to S.R.

Friends of S.R. and E.W. were aware that the couple would commonly indulge in alcohol and cocaine. E.W.'s best friend relays that E.W. knew that S.R. was unstable and that the affair was a dangerous one. The friend stated that E.W. once remarked that "she knew that if she stayed with him, he'd kill her." "She said he was like a drug... and she couldn't stay away," the friend recalled. Many witnesses said that they openly discouraged the relationship. Nonetheless, E.W. continued the affair.

In June 2004, the eight-man, four-woman jury deliberated for 13 hours to deliver its unanimous verdict finding: S.R. was guilty of first-degree murder. S.R. sat in expressionless silence after the decision was read. According to California state law, the verdict carries with it a life sentence in prison. The prosecution contends that S.R.'s rage was provoked by E.W., and that his knowledge of sleepwalking allowed him to "lie convincingly about the night he killed E.W." Additionally, the prosecution believes that the explicit nature of the crime scene photographs were enough to sway the jury towards their decision. However, the defense team remained confident about their client's innocence and vowed to appeal the decision.

The case came to a complete closure in August 2004 when the Long Beach Superior Court judge rejected the

defense team's request to grant a new trial or reduce the conviction from first-degree murder to second degree. S.R. was sentenced to 26 years to life in prison.

Sleep-related Violence

State-dependent violence

Sleep is not simply the passive absence of wakefulness; rather, sleep is comprised of two completely different and active states: non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep. These three states of being are not mutually exclusive. The simultaneous admixture or rapid oscillation of wakefulness and sleep may result in bizarre behavioral syndromes with forensic science implications [2,3].

The concept that violent or injurious behaviors may arise in the absence of conscious wakefulness and without conscious awareness is supported by animal experiments. The widely held concept that the brainstem and other more "primitive" neural structures primarily participate in elemental/vegetative rather than behavioral activities is inaccurate. There are overwhelming data documenting that highly complex emotional and motor behaviors can originate from these more primitive structures, without involvement of higher neural structures such as the cortex [4,5]. The structures subserving primitive behaviors are in close proximity to sleep/wake promoting regions of the brainstem.

Sleep-related disorders associated with violence

Violent sleep-related behaviors have been recently reviewed in the context of automatic behavior in general [6••]. There are well-documented cases of 1) somnambulistic homicide, filicide, attempted homicide, and suicide; 2) murders and other crimes with sleep drunkenness (confusional arousals); and 3) sleep terrors/sleepwalking with potential violence/injury. A wide variety of disorders may result in sleep-related violence. These conveniently fall into two major categories: neurologic and psychiatric.

Neurologic Conditions Associated with Violent Behaviors

The most common human conditions associated with sleep-related violent behaviors are disorders of arousal, REM sleep behavior disorder (RBD), and sleep-related seizures.

Disorders of arousal

The disorders of arousal comprise a spectrum ranging from confusional arousals (sleep drunkenness) to sleepwalking to sleep terrors [7]. The disorders of arousal represent an admixture of wakefulness and NREM sleep, resulting in the ability to perform protracted complex behaviors without conscious awareness, and, therefore, without responsibility. Although there is usually amne-

sia for the event [8,9], vivid dream-like mentation may occasionally be experienced and reported [10]. The disorders of arousal may actually begin in adulthood, and, contrary to popular opinion, are most often not associated with psychopathology [10,11]. Recent large population surveys indicate that the disorders of arousal are more prevalent in the adult population than previously thought, being reported by 3% to 4% of all adults and occurring weekly in 0.4% [12].

Febrile illness, alcohol, prior sleep deprivation, and emotional stress may serve to trigger disorders of arousal in susceptible individuals. Medications such as sedative/hypnotics, neuroleptics, minor tranquilizers, stimulants, and antihistamines, often in combination with each other or with alcohol, may also play a role. Many of the reported medico-legal cases of sleepwalking-related violence involved alcohol consumption in an individual prone to experience spontaneous disorders of arousal. Treatment of the disorders of arousal include both pharmacologic (benzodiazepine and tricyclic antidepressant) and behavioral (hypnosis) approaches [7,13].

Importantly, there are various associations between obstructive sleep apnea and confusional arousals. Patients suffering from obstructive sleep apnea may experience frequent arousals that may serve to trigger arousal-induced precipitous motor activity [14]. Therefore, the observed clinical behavior (*ie*, a confusional arousal) is actually the result of another underlying primary sleep disorder—obstructive sleep apnea. This is another example of why overnight polysomnographic studies with extensive physiologic monitoring are mandatory in the evaluation of problematic motor parasomnias. Furthermore, incompletely treated obstructive sleep apnea may result in confusional states during wakefulness, as exemplified by a patient who suffered a self-inflicted gunshot wound to his head while trying to apply his bilevel positive airway pressure headgear [15].

Disorders of arousal and human violence

The commonly held belief that disorders of arousal are always benign is erroneous. The accompanying behaviors may be violent, resulting in considerable injury to the individual, to others, or in damage to the environment [2,10].

Specific incidents include 1) somnambulistic homicide, attempted homicide, and filicide; 2) murders and other crimes with sleep drunkenness, including sleep apnea and narcolepsy; 3) suicide or fear of committing suicide; 4) sleep terrors/sleepwalking with potential violence/injury; and 5) inappropriate sexual behaviors during the sleep state, presumably the results of an admixture of wakefulness and sleep [6].

Some very dramatic cases have been tried using the confusional arousal defense. In one, the Parks case in Canada, the defendant drove 23 kilometers, killed his mother-in-law, and attempted to kill his father-in-law. Somnambulism was the legal defense, and the defen-

dant was acquitted [16]. In another, the Butler, PA case, a confusional arousal attributed to underlying obstructive sleep apnea was offered as a criminal defense for a man who fatally shot his wife during his usual sleeping hours. He was found guilty [17]. Also, accidental death resulting from self-injury incurred during sleepwalking may be erroneously attributed to suicide [18,19].

REM sleep behavior disorder

Normally, during REM sleep, there is active paralysis of all somatic muscles (sparing the diaphragm and extraocular muscles). In REM sleep behavior disorder (RBD), there is the absence of REM sleep atonia, which permits the “acting out” of dreams, often with dramatic and violent or injurious behaviors. These oneiric behaviors displayed by patients with RBD are often misdiagnosed as manifestations of a seizure or psychiatric disorder. The violent and injurious nature of RBD behaviors has been extensively reviewed elsewhere [20]. Treatment with clonazepam is highly effective.

Recently, a parasomnia overlap syndrome, which contains clinical and polysomnogram features of disorders of arousal and RBD, has been described [21]. Other sleep disorders, such as disorders of arousal, underlying sleep apnea, and nocturnal seizures, may perfectly simulate RBD, again underscoring the necessity for thorough formal polysomnographic evaluation of these cases.

Nocturnal seizures

Rarely, seizures may result in violent, murderous, or injurious behaviors [2,22]. As mentioned earlier, other sleep disorders such as obstructive sleep apnea or RBD may masquerade as nocturnal seizures.

Psychiatric Conditions

Psychogenic dissociative states

Psychogenic dissociative disorders may arise exclusively or predominantly from the sleep period. Virtually all patients with nocturnal dissociative disorders evaluated at our center were victims of repeated physical and/or sexual abuse beginning in childhood [23].

Post-traumatic stress disorder

Dissociative states and injury related to nightmare behaviors have been reported in association with post-traumatic stress disorder [24,25].

Malingering

Although uncommon, malingering must also be considered in cases of apparent sleep-related violence. Our center has seen a young adult male patient who developed progressively violent behaviors apparently arising from sleep directed exclusively at his wife. This behavior included beating and chasing her with a hammer. Following exhaustive neurologic, psychiatric, and polysomnographic evaluation,

it was determined that this behavior represented malingering. It was suspected that he was attempting to have the sleep center legitimize his behaviors, should his wife be murdered during one of these episodes.

Munchausen syndrome by proxy

In this recently described syndrome, a child is reported to have apparently medically serious symptoms, which, in fact, are induced by an adult, usually a caregiver and often a parent. The use of surreptitious video monitoring in sleep disorder centers during sleep (with the parent present) has documented the true etiology for reported sleep apnea and other unusual nocturnal spells.

Medico-legal Evaluation

Automatisms and the law

Although the medical concept of automatism is relatively straightforward (complex behavior in the absence of conscious awareness or volitional intent), the judicial concept is quite different. Legally, there are two forms of automatism: sane and insane. The sane automatism results from an external or extrinsic factor, and the insane from an internal or endogenous cause. This choice results in two very different consequences for the accused: commitment to a mental hospital for an indefinite period of time if insane, or acquittal without any mandated medical consultation or follow-up if sane. For example, a criminal act resulting from altered behavior due to hypoglycemia induced by injection of too much insulin would be a sane automatism, whereas the same act, if due to hypoglycemia caused by an insulinoma would be an insane automatism. By this unscientific paradigm, criminal behavior associated with epilepsy is, by definition, an insane automatism [26,27]. In the United States, the approach to automatism varies from state to state [28].

The current legal system, unfortunately, must consider a sleep-related violence case strictly in terms of choosing between insane or nonsane automatism, without any stipulated deterrent concerning a recurrence of sleepwalking with criminal charges that was induced by a recurrence of the high-risk behavior. If sleepwalking is deemed an insane automatism, then a significant percentage of the general population is legally insane. Clearly, dialogue between the medical and legal professions regarding this important area would be helpful to both professions and to those arrested during automatisms [29]. One fortunate, and unexplained, fact is that nocturnal sleep-related violence is hardly ever a recurrent phenomenon [30].

The role of the sleep medicine specialist

With the identification of ever-increasing causes, manifestations, and consequences of sleep-related violence comes an opportunity for neurologists and sleep medicine specialists to educate the general public and practicing clinicians

as to the occurrence and nature of such behaviors and about their successful treatment. More importantly, the onus is on the sleep medicine professional to educate and assist the legal profession in cases of sleep-related violence that result in forensic medicine issues. This often presents difficult ethical problems, as most "expert witnesses" are retained by either the defense or the prosecution, leading to the tendency for expert witnesses to become an advocate for either one side or the other. Historically, this has been fertile ground for the appearance of "junk science" in the courtroom [31]. To address the problem of junk science in the courtroom, many professional societies are calling for, and some have developed guidelines for, expert witness qualifications and testimony. Similarly, the American Academy of Sleep Medicine and the American Academy of Neurology have adopted their own guidelines [32,33]. Familiarizing oneself with these guidelines may be helpful in a given case, as the expert witness from each side should be held to the same standards [34].

Clinical and laboratory evaluation of waking and sleep violence

The history of complex, violent, or potentially injurious motor behavior arising from the sleep period should suggest the possibility of one of the previously mentioned conditions. Our experience with over 200 adult cases of sleep-related injury/violence has repeatedly indicated that clinical differentiation without polysomnographic study among RBD, disorders of arousal, sleep apnea, and sleep-related psychogenic dissociative states and other psychiatric conditions is often impossible [35].

The legal implications of automatic behavior have been discussed and debated in both the medical and legal literature. The identification of a specific underlying organic or psychiatric sleep/violence condition does not establish causality for any given deed. Two questions accompany each case of reportedly sleep-related violence: 1) is it possible for behavior this complex to have arisen in a mixed state of wakefulness and sleep without conscious awareness or responsibility for the act? and 2) is that what happened at the time of the incident? The answer to the first is often yes, but the second can never be determined with surety, as the thief has fled in the night. Unfortunately, there are no reliable polysomnographic findings that, after the fact, could establish a sleep-related event as causative for remote behavior [36–38].

To assist in the determination of the putative role of an underlying sleep disorder in a specific violent act, we have proposed guidelines, modified from Bonkalo (sleepwalking) [39], Walker (epilepsy) [40], and Glasgow (automatism in general) [41] and formulated from our clinical experience [2] the following ideas:

1. There should be reason (by history or formal sleep laboratory evaluation) to suspect a bona fide sleep disorder. Similar episodes, with benign

or morbid outcome, should have occurred previously. (It must be remembered that disorders of arousal may begin in adulthood.)

2. The duration of the action is usually brief (minutes).
3. The behavior is usually abrupt, immediate, impulsive, and senseless, without apparent motivation. Although ostensibly purposeful, it is completely inappropriate to the total situation, out of (waking) character for the individual, and without evidence of premeditation.
4. The victim is someone who merely happened to be present and who may have been the stimulus for the arousal.
5. Immediately following return of consciousness, there is perplexity or horror, without attempt to escape, conceal, or cover-up the action. There is evidence of lack of awareness on the part of the individual during the event.
6. There is usually some degree of amnesia for the event; however, this amnesia need not be complete.
7. In the case of sleep terrors/sleepwalking or sleep drunkenness, the act may a) occur upon awakening (rarely immediately upon falling asleep), usually at least 1 hour after sleep onset; b) occur upon attempts to awaken the subject; and c) have been potentiated by alcohol ingestion, sedative/hypnotic administration, or prior sleep deprivation.

The proposition that sleep disorders may be a legitimate defense in cases of violence arising from the sleep period has been met with immense skepticism [30]. For credibility, evaluations of such complex cases are best performed in experienced sleep disorders centers with interpretation by a veteran clinical polysomnographer. Due to the complex nature of many of these disorders, a multidisciplinary approach is highly recommended [35, 42].

Conclusions

It is abundantly clear that violence may occur during any one of the three states of being. That which occurs during REM or NREM sleep may have occurred without conscious awareness and is due to one of a number of completely different disorders. Violent behavior during sleep may result in events that have forensic science implications. The apparent suicide (*eg*, leap to death from a second-storey window), assault (*eg*, molestation), or murder (*eg*, strangulation, stabbing, shooting) may be

the unintentional, nonculpable, but catastrophic result of disorders of arousal, sleep-related seizures, RBD, or psychogenic dissociative states. The majority of these conditions are diagnosable and, more importantly, are treatable. The social and legal implications are obvious.

More research, both basic science and clinical, is urgently needed to further identify and elaborate upon the components of both waking and sleep-related violence, with particular emphasis upon neurobiologic, neuroplastic, genetic, and socioenvironmental factors. The study of violence and aggression will be greatly enhanced by close cooperation among clinicians, basic science researchers, and social scientists.

References and Recommended Reading

Papers of particular interest, published recently, have been highlighted as:

- Of importance
 - Of major importance
1. Ohayon MM, Caulet M, Priest RG: **Violent behavior during sleep.** *J Clin Psychiatry* 1997, 58:369–376.
 2. Mahowald MW, Bundlie SR, Hurwitz TD, Schenck CH: **Sleep violence-forensic science implications: polygraphic and video documentation.** *J Forensic Sci* 1990, 35:413–432.
 3. Mahowald MW, Schenck CH: **Dissociated states of wakefulness and sleep.** *Neurology* 1992, 42:44–52.
 4. Grillner S, Dubic R: **Control of locomotion in vertebrates: spinal and supraspinal mechanisms.** *Adv Neurol* 1988, 47:425–453.
 5. Bandler R: **Brain Mechanisms of aggression as revealed by electrical and chemical stimulation: suggestion of a central role for the midbrain periaqueductal region.** *Prog Psychobiol Physiol Psychol* 1988, 13:67–154.
 6. Mahowald MW, Schenck CH: **Parasomnias: sleepwalking and the law.** *Sleep Med Rev* 2000, 4:321–339.
- This is a comprehensive review of the forensic aspects of sleep-related complex behaviors.
7. Mahowald MW, Schenck CH: **NREM parasomnias.** *Neurol Clin* 1996, 14:675–696.
 8. Fisher C, Kahn E, Edwards A, et al.: **A psychophysiological study of nightmares and night terrors. III. Mental content and recall of stage 4 night terrors.** *J Nerv Ment Dis* 1974, 158:174–188.
 9. Thorpy MJ, for the Diagnostic Classification Steering Committee: **ICSD—International Classification of Sleep Disorders: Diagnostic and Coding Manual.** Rochester, MN: American Sleep Disorders Association; 1990.
 10. Schenck CH, Hurwitz TD, Bundlie SR, Mahowald MW: **Sleep-related injury in 100 adult patients: a polysomnographic and clinical report.** *Am J Psychiatry* 1989, 146:1166–1173.
 11. Hartmann E, Greenwald D, Brune P: **Night-terrors-sleep walking: personality characteristics.** *Sleep Res* 1982, 11:121.
 12. Hublin C, Kaprio J, Partinen M, et al.: **Prevalence and genetics of sleepwalking; a population-based twin study.** *Neurology* 1997, 48:177–181.
 13. Remulla A, Guillemault C: **Somnambulism (sleepwalking).** *Expert Opin Pharmacother* 2004, 5:2069–2074.
 14. Espa F, Dauvilliers Y, Ondze B, et al.: **Arousal reactions in sleepwalking and night terrors in adults: the role of respiratory events.** *Sleep* 2002, 25:871–875.

Whether sleep-related breathing is a frequent underlying phenomenon in many individuals with disorders of arousal remains to be determined.

15. Baron J, Auckley D: **Gunshot wound to the head: an unusual complication of sleep apnea and bilevel positive airway pressure.** *Sleep Breathing* 2004, 8:161–164.
16. Broughton R, Billings R, Cartwright R, et al.: **Homicidal somnambulism: a case report.** *Sleep* 1994, 17:253–264.
17. Nofzinger EA, Wettstein RM: **Homicidal behavior and sleep apnea; a case report and medicolegal discussion.** *Sleep* 1995, 18:776–782.
18. Mahowald MW, Schenck CH, Goldner M, et al.: **Parasomnia pseudo-suicide.** *J Forensic Sci* 2003, 48:1158–1162.
19. Shatkin JP, Feinfield K, Strober M: **The misinterpretation of a non-REM sleep parasomnia as suicidal behavior in an adolescent.** *Sleep Breathing* 2002, 6:175–179.
20. Schenck CH, Mahowald MW: **REM sleep behavior disorder: clinical, developmental, and neuroscience perspectives 16 years after its formal identification in Sleep.** *Sleep* 2002, 25:120–130.
21. Schenck CH, Boyd JL, Mahowald MW: **A parasomnia overlap disorder involving sleepwalking, sleep terrors, and REM sleep behavior disorder in 33 polysomnographically confirmed cases.** *Sleep* 1997, 20:972–981.
22. Hindler CG: **Epilepsy and violence.** *Br J Psychiatry* 1989, 155:246–249.
23. Schenck CS, Milner DM, Hurwitz TD, et al.: **Dissociative disorders presenting as somnambulism: polysomnographic, video, and clinical documentation (8 cases).** *Dissociation* 1989, 4:194–204.
24. Coy JD: **Letter to Editor.** *J Emerg Med* 1996, 14:760–762.
25. Bisson JI: **Automatism and post-traumatic stress disorder.** *Br J Psychiatry* 1993, 163:830–832.
26. Fenwick P: **Automatism, medicine, and the law.** *Psychol Med Monograph Supplement I* 1990, 17:1–27.
27. Fenwick P: **Epilepsy, automatism, and the English Law.** *Med Law* 1997, 16:349–358.
28. McCall Smith A, Shapiro CM: **Sleep disorders and the criminal law.** In *Forensic Aspects of Sleep*. Edited by Shapiro C, McCall Smith A. Chichester: John Wiley & Sons; 1997:29–64.
29. Thomas TN: **Sleepwalking disorder and mens rea: a review and case report.** *J Forensic Sci* 1997, 42:17–24.
30. Guillemainault C, Moscovitch A, Leger D: **Forensic sleep medicine: nocturnal wandering and violence.** *Sleep* 1995, 18:740–748.
31. Huber PW: *Galileo's Revenge. Junk Science in the Courtroom.* New York: Basic Books; 1991.
32. Sagsveen MG: **American Academy of Neurology policy on expert medical testimony [editorial].** *Neurology* 2004, 63:1555–1556.
33. Freeman JM, Nelson KB: **Expert medical testimony. Responsibilities of medical societies.** *Neurology* 2004, 63:1557–1558.
34. Mahowald MW, Schenck CH: **Complex motor behavior arising during the sleep period: forensic science implications.** *Sleep* 1995, 18:724–727.
35. Mahowald MW, Schenck CH, Rosen GR, Hurwitz TD: **The role of a sleep disorders center in evaluating sleep violence.** *Arch Neurol* 1992, 49:604–607.
36. Pressman MR: **Hypersynchronous delta sleep EEG activity and sudden arousals from slow-wave sleep in adults without a history of parasomnias: clinical and forensic implications.** *Sleep* 2004, 27:706–710.
37. Schenck CH, Pareja JA, Patterson AL, Mahowald MW: **An analysis of polysomnographic events surrounding 252 slow-wave sleep arousals in 38 adults with injurious sleepwalking and sleep terrors.** *J Clin Neurophysiol* 1998, 15:159–166.
38. Cartwright R: **Sleep-related violence: does the polysomnogram help establish the diagnosis?** *Sleep Med* 2000, 1:331–335.
39. Bonkalo A: **Impulsive acts and confusional states during incomplete arousal from sleep: criminological and forensic implications.** *Psychiatric Q* 1974, 48:400–409.
40. Walker EA: **Murder or epilepsy?** *J Nerv Ment Dis* 1961, 133:430–437.
41. Glasgow GL: **The anatomy of automatism.** *N Z Med J* 1965, 64:491–495.
42. Aldrich MS, Jahnke B: **Diagnostic value of video-EEG polysomnography.** *Neurology* 1991, 41:1060–1066.