A Polysomnographically Documented Case of Adult Somnambulism With Long-Distance Automobile Driving and Frequent Nocturnal Violence: Parasomnia With Continuing Danger as a Noninsane Automatism?

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Summary: A case of childhood-onset somnambulism is reported in which a 43-year-old man presented with repeated sleep-related injuries incurred during violent nocturnal activity, which included frenzied running, throwing punches and wielding knives. He had also driven an automobile a long distance during a presumed somnambulistic state. His wife had been repeatedly injured, and she felt that her life was threatened by his nocturnal violence 2–3 times yearly. Polysomnography (PSG) documented multiple episodes of complex and violent behaviors arising exclusively from stage 3/4 sleep, thus confirming the diagnosis of somnambulism. Other causes of sleep-related violence were excluded. The patient responded promptly to treatment with bedtime clonazepam, and benefit was maintained at 5-year follow-up. Although this strictly clinical case did not have any legal repercussions, it does carry forensic implications, particularly when placed in the context of the published medical literature on PSG-documented parasomnias (somnambulism, rapid eye movement sleep behavior disorder) containing explicit examples of recurrent violence, at times life-threatening, directed toward the bed partner and others. Thus, a new medical–legal concept is proposed, consisting of "parasomnia with continuing danger" as a noninsane automatism. Treatment guidelines, within the context of forensic medicine, are presented. **Key Words:** Somnambulism—Parasomnia—Sleep-related injury—Violence—Polysomnography—Forensic medicine—REM sleep behavior disorder.

A landmark case of homicidal somnambulism was recently reported by Broughton et al. ("the Parks case"), involving a 23-year-old man who, during a presumed somnambulistic state, drove his automobile 23 kilometers and then stabbed his mother-in-law to death (1). He was acquitted of murder charges by a jury in a Canadian court on the basis of somnambulism—regarded legally as a noninsane automatism with very low probability of violent recurrence (1). The evidence supporting the diagnosis of somnambulism consisted of a childhood-onset history of somnambulism, a strong family history of somnambulism, polysomnographic findings consistent with somnambulism, a sequence of behaviors during the episode in question that was much more consistent with somnambulism than with wake-

ful premeditated behavior, the conjunction of three potent risk factors known to trigger somnambulism in at-risk individuals (marked sleep deprivation, major psychological stress and physical overexertion) and the lack of evidence for psychogenic dissociative disorder or for malingering.

We now report what is to our knowledge the second polysomnographically (PSG) documented case of somnambulism involving both sleep-related automobile driving and nocturnal violence. Our clinical case, although unassociated with any legal charges, does have forensic implications, and both reinforces and expands on the findings and arguments contained in the Parks report (1).

CASE REPORT

Clinical background

A 43-year-old married man presented with a long-standing, injurious sleep behavior disorder. Somnam-

bulism began at the age of 5 years, when he would jump on his bed and run around the house. Roommates in college, in the military and while he was working as a salesman before marriage all observed violent nocturnal behaviors that, by the age of 25 years, occurred 5–7 nights weekly and emerged 1–3 hours after sleep onset. He often engaged in strenuous activity that he could not duplicate in the daytime, such as lifting a large mattress over his head or pushing a heavy dresser across a room. During the course of a parasomnia episode, which according to the wife usually lasted 1–2 minutes, the patient would be completely unarousable. There was usually subsequent amnesia, with some notable exceptions that are described below. He also demonstrated analgesia while incurring nocturnal injuries (e.g. fractures, lacerations and wood splinters driven deep under the skin of his toes and feet), and would first experience pain the following day.

Presumed somnambulistic automobile driving occurred at the age of 25 years when, one night, he jumped out of bed during perceived "deep sleep with dreaming" in which he believed that someone was in the house and about to attack him. He then urgently sought safety and, while still clad in pajamas, he left the house by running through a screen door, entered his automobile and drove 8 kilometers to his parents' home without an accident, and awakened them by pounding on their door. He did not carry a weapon with him. While driving the automobile, he was only aware that he was driving to his parents' home to escape an intruder at his own home. He denied experiencing any stress during the preceding day, or having any interpersonal problems with his parents, with whom he had a good relationship, as confirmed by his wife. He also denied any excessive alcohol use or any illicit drug use.

The patient had been married 15 years and had four children. The patient was 6 feet 3 inches and his wife was 5 feet 6 inches in height. Throughout their marriage, his wife was disturbed by his parasomnia episodes on a nearly nightly basis, with some diminution during vacations. There were various "stages" of nocturnal weapon wielding and of other patterned behaviors that usually occurred for weeks or months before inexplicable switches to other "stages". The most common stage involved stabbing at furniture or at the air with knives; another stage involved the swinging and throwing of baseball bats; another stage involved taking a shower "to get the bad stuff off me"; another stage involved running out of the house; another stage, which lasted for years during early adulthood, consisted of sleep terrors with frenzied somnambulism.

The patient had injured his wife on many occasions by punching her and once attempted to strangle her. He also had fractured his own fingers from punching hard objects and had sustained frequent lacerations,

ecchymoses, knee injuries and sprained ankles while colliding with doorways and furniture, and from falling down the staircase. Nearly all episodes, according to his wife, began with his "flying out of bed" in a highly energized state.

Although the patient often felt "exhausted" during the daytime, there was no history of sleep attacks, cataplexy, sleep paralysis or hypnagogic/hypnopompic hallucinations.

The spousal perspective

The risk of recurrent injury and lethality to the wife was explored during two separate interviews with her, while the patient was not present. She estimated that during 2–3 parasomnia episodes yearly, for a total of approximately 50 episodes during their marriage, she had been punched by her husband, incurring ecchymoses ("multicolored bruises and big lumps"), and "his knuckles would be imprinted on my skin". She considered these episodes to be potentially life-threatening. During fewer episodes, he nearly stabbed her with a kitchen knife that he was swinging wildly in the air or into the bed. His vocalizations and facial expression indicated to her that "something was threatening him"; although his eyes would be wide open, he was not actually seeing her, but rather a perceived dreamed object. On one occasion, he picked up his sleeping wife "and flung me up in the air and then dropped me on the hardwood floor".

Her description of his attempt to strangle her was as follows: "He later told me that he was dreaming that someone was trying to strangle *me* and so he was trying to pry the attacker's hands off me. But actually, his hands were wrapped around my neck, while my hands were around his hands—trying to pry his hands off my neck. It was my screaming that finally woke him up".

She also mentioned that on most nights she had to "rely on my agility and quickness to have my husband not hurt me". Episodes in which she felt a direct threat to her life often occurred during nights in which "I had become so exhausted from getting up so many times because of my husband's rages that I became really vulnerable".

In regard to why she remained in bed, or even in the same house, with her husband throughout the many years of his violent parasomnia, she mentioned that i) "I felt sorry for him; I knew it wasn't his fault"; ii) "For a long time I tried many different things to have him not get out of bed or become wild, but nothing worked"; iii) "There was no other place in our small house, with four children, for me to sleep"; iv) "I did not have the finances to move myself and our four children elsewhere—not even to spend a night at a

motel"; v) She believed that she could somehow manage to survive, since she felt severely threatened "only" 2–3 times yearly, and since her husband had never endangered their children—apart from one episode in which he grabbed them from their beds, carried them into the master bedroom, and dropped them onto the bed; and, finally, vi) "I just tried not to think about being murdered."

Unsuccessful treatments

The following treatments had been unsatisfactory: tying himself to the bed, or to his wife, with a rope; altering his diet in various ways; engaging in heavy evening workouts at the gym to "exhaust" himself before bedtime; taking various bedtime medications, including tricyclic antidepressants and carbamazepine; hypnotherapy; and a 3-month course of psychotherapy, focusing on relaxation and uncovering any contributory psychological disturbance (none was found).

Medical history

The patient's medical history was benign. Prior psychiatric, medical and neurological evaluations and a waking EEG had been unremarkable. There was no history of psychiatric disorder, apart from claustrophobia and a tendency for daytime temper outbursts, without altered consciousness. The wife reported occasional shouting, door slamming and object throwing (but never aiming at anyone), after which he would always be apologetic. Daytime automatisms had never been observed, and the patient denied any recurrent, peculiar, experiential or amnesic states occurring during wakefulness. There was no history of physical or sexual abuse. There was no history of alcohol or substance abuse: he imbibed one alcoholic beverage each weeknight and four over the course of a weekend, and he consumed three cups of coffee daily. He was quite athletically inclined and worked out at a gym two or three times weekly. Although somewhat dissatisfied with his current job as an engineer, he considered it much less stressful than his previous job as a salesman. He and his wife described having a stable and enjoyable marriage and family life. He regularly coached his children's sports teams. Family history was negative for any sleep or psychiatric disorder.

Clinical evaluation and polysomnographic findings

The patient completed a standard, extensive sleep–wake, medical, psychiatric history and review-of-systems questionnaire that was discussed during the clinical sleep–wake and psychiatric interview with one of the authors (C.H.S.), who also interviewed the patient's wife separately. A psychiatric disorder was not identified, apart from a mild adjustment disorder with depressed and anxious features, which was related to his persistent sleep disorder. A Minnesota Multiphasic Personality Inventory (MMPI) (2) supported this clinical impression; the chief psychologist, who was blind to the clinical history, identified mild-to-moderate depression, anxiety symptoms and obsessive-compulsive traits. (The Welsh code for the MMPI was 72'34-6081/5:9#F-K/L:.) However, clinical levels of depression or anxiety were not detected by i) the Beck Depression Inventory (3), with a score of 4; ii) the Zung Self-Rating Anxiety Scale (4), with an index score of 41 or iii) the Symptom Checklist-90 (SCL-90) (5) depression and anxiety subscales, with scores of 0.54 and 0.4, respectively. Apart from a modestly elevated obsessive-compulsive subscale score of 1.2, there was no subscale elevation in the SCL-90, which also measured for hostility, interpersonal insensitivity, paranoia, phobic anxiety and psychosis; the SCL-90 global severity index score of 0.5 likewise was not elevated.

The patient underwent two consecutive, overnight, hospital-based PSG studies using standard recording and scoring methods (6), with additional extensive electromyographic and EEG monitoring and paper speeds of 15 and 30 mm/second, as depicted in Fig. 1; there was continuous audiovisual monitoring (7). He had been unmedicated for several months prior to the PSG studies, and a urine toxicology screen was negative.

Both PSG studies, which were reviewed by an experienced polysomnographer (M.W.M.), were diagnostic of a NREM sleep parasomnia, viz. somnambulism (7–12), with several abrupt arousals from stage 3/4 sleep associated with sitting up rapidly, looking around with confusion, vocalizing (e.g. "ready to go guys", "oh what!") and throwing repeated punches. On several occasions, the patient was about to leave the bed and engage in frank somnambulism until the technician promptly intervened to abort the potentially dangerous activity. EEG features of wakefulness did not usually become established during these episodes. Fig. 1 depicts one such event, in which there was vocalizing and punching.

Table 1 contains the sleep architecture and related PSG data. The sleep efficiency was excellent during the first PSG study, but was low during the second. The REM sleep percentage was somewhat elevated during the first PSG study and somewhat low during the second. The REM sleep latency was moderately brief during both PSG studies. There were excessive, abrupt spontaneous arousals (<30 seconds duration) from all stages of sleep during both PSG studies, with hourly indices of 13 and 18, respectively. Figure 2 contains histograms of the two PSG studies; slow-wave (stage
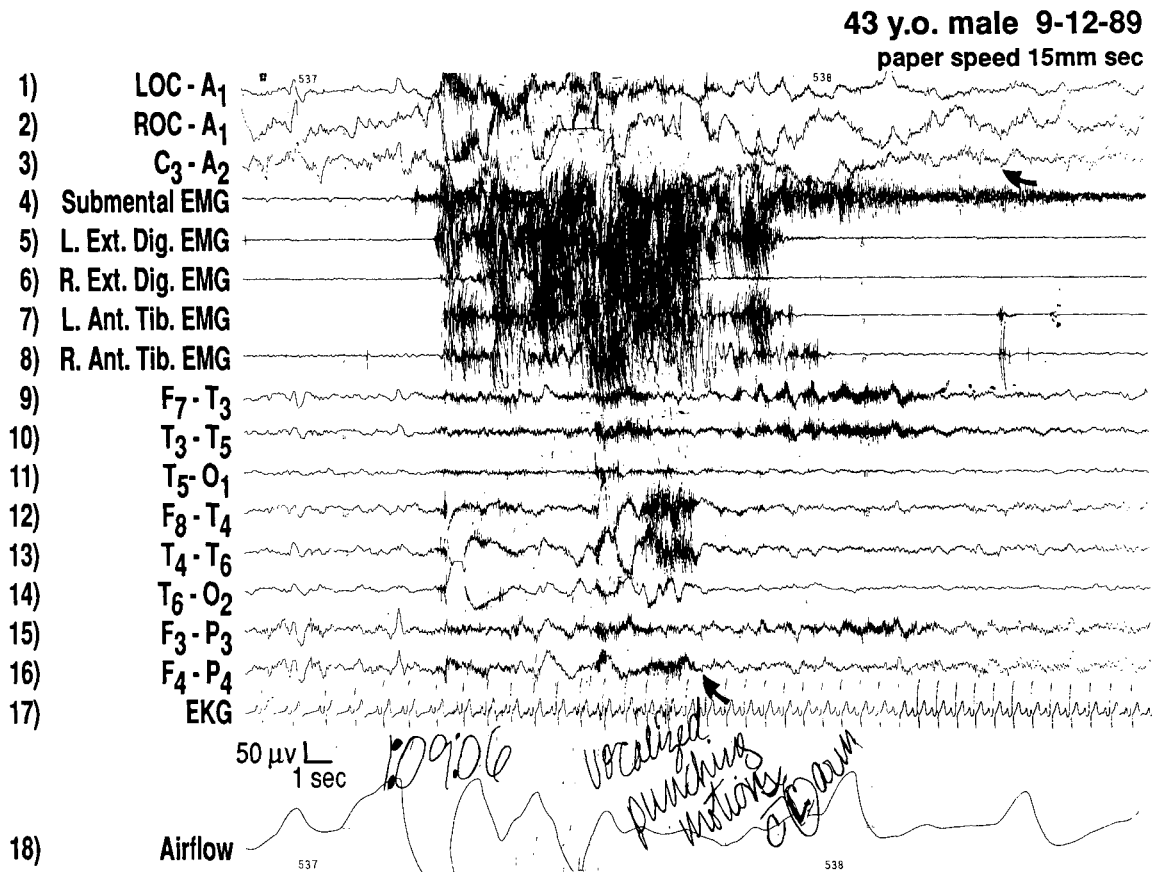
FIG. 1. Polysomnogram during stage 3/4 sleep depicting an NREM sleep parasomnia episode. On the left side of the figure, there is uneventful EEG delta-wave activity that is devoid of hypersynchrony (3, 9–16). Without any preceding tachycardia (17), tonic or phasic electromyographic (EMG) activity (4–8), or eye movements (1, 2), there is a sudden arousal marked by vocalization and aggressive behavior, as noted in writing by the technician. Despite the behavioral activation with tachycardia, sleep persists on the EEG throughout most of the recording and is clearly present once the muscle artifact subsides (see arrows).

3/4) sleep is notably distributed throughout most of the sleep cycle during each PSG study.

Neither behavioral nor EEG seizure-like spells were detected, nor were there any dissociative psychogenic spells arising during established EEG wakefulness. REM sleep behavior disorder, periodic limb movements, sleep-disordered breathing and other sleep pathology (8) were also not present. A multiple sleep latency test (13) did not reveal objective daytime somnolence. Mean sleep latency was 14 minutes.

Treatment outcome

The patient was treated with clonazepam, 1.0 mg taken 1–2 hours before sleep onset. Clonazepam was chosen because our center had been successful with it in treating a large number of adults having injurious somnambulism (7). Clonazepam was promptly beneficial, and at 5-year follow-up the patient and his wife reported full control of sleep-related injury, which had been sustained without any relapse, except when he forgot to take the drug.

DISCUSSION

This case concerns an adult with PSG-documented somnambulism who engaged in nocturnal violence with weapon wielding, and who also drove an automobile one night for a long distance in an altered state of presumably admixed sleep and wakefulness. The core elements of this case bear a striking resemblance to the core elements of the Parks case (1). However, there are also distinctions between the two cases. In the Parks case, there was amnesia for the automobile drive and subsequent stabbing of the in-laws. The subject in that case was apparently "going after" someone during this event. In our case, the driving occurred in a mixed sleep/wake state with only partial amnesia, since the patient recalled being intent on escaping from someone who was trying to harm him. Also, in our case, he did fully arouse shortly after his parents responded to his pounding on their door.

Thus, these two cases reinforce the medical–legal precedent of classifying somnambulism as a noninsane automatism, a physiological disorder of sleep, and not
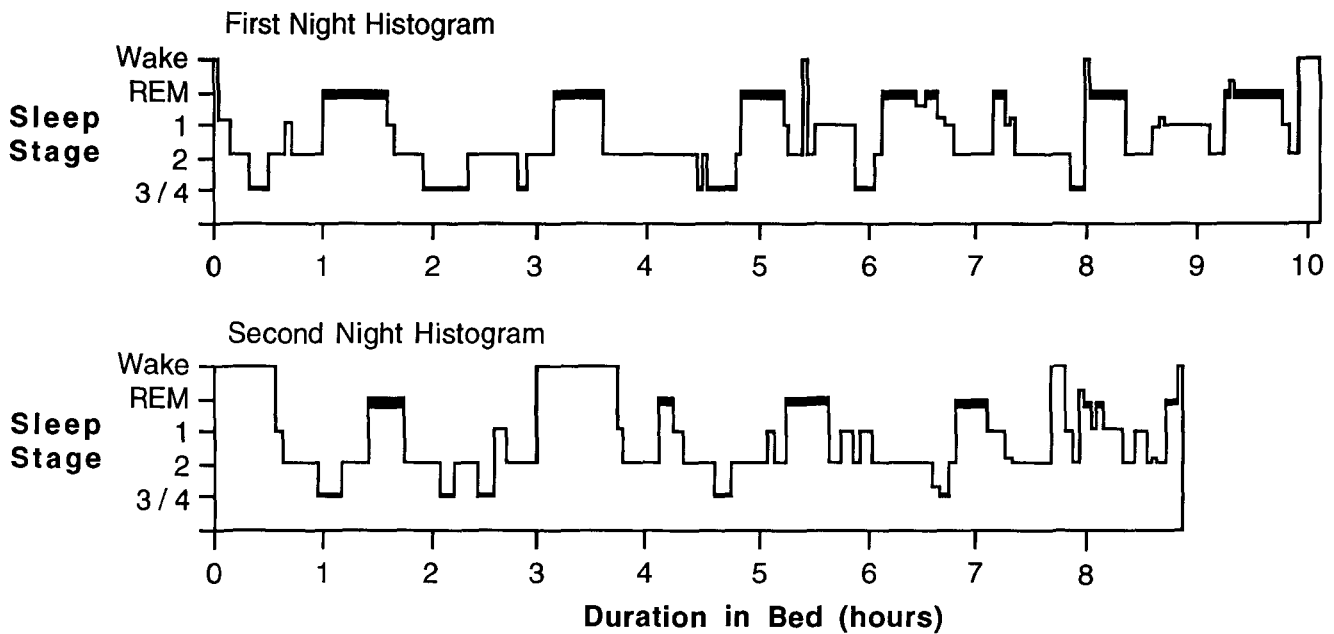
FIG. 2. Histograms of two consecutive polysomnographic studies showing persistence of stage 3/4 sleep throughout most of the sleep cycle.

as a disease of the mind or a psychiatric disorder per se. The stringent criteria of Mahowald et al. (14) may be helpful in regard to the weight of evidence required both to establish the diagnosis of somnambulism and to exclude other etiologies of complex and violent nocturnal behaviors (7,8,14,15).

Long-distance, sleep-related automobile driving can also occur with nocturnal dissociative disorders (16,17). However, neither in our case nor in the Parks case was there any history of daytime dissociation or any history of physical or sexual abuse—a hallmark of dissociative disorders (18).

Our case does differ from the Parks case in one other important aspect, which suggests the need to recognize the existence of, and to develop guidelines for, a new branch of forensic sleep medicine concerning the risk of "continuing danger" in medical–legal parasomnia

TABLE 1. *Sleep architecture and related measures obtained during two consecutive overnight polysomnographic (PSG) studies in a 43-year-old man with longstanding violent somnambulism*

Sleep measures	PSG study 1	PSG study 2
Total sleep time (minutes)	577.5	432.5
Sleep efficiency (%) (minutes asleep/minutes in bed)	95.7	81.3
Stage 1 sleep (%)	15.8	17.4
Stage 2 sleep (%)	41.7	53.3
Stage 3/4 sleep (%)	12.2	12.4
Stage REM sleep (%)	30.3	16.9
Latency to stage 1 sleep (minutes)	4.5	17.5
Latency to stage 2 sleep (minutes)	9.5	41.0
Latency to REM sleep (minutes)	55.3	52.5

cases. In the Parks case, the risk of recurrent, violent somnambulism was considered to be very low, given i) the low frequency of parasomnia during adulthood and ii) the extraordinary set of circumstances and triggering factors that were deemed unlikely to recur. In contrast, with our case, given the current constraints of the law, if there had been an allegedly criminal act, it would have been impossible to argue for acquittal on the basis of minimal risk of "continuing danger" from the parasomnia, because violent somnambulism had recurred with high frequency for many years. Thus, an additional medical–legal concept needs to be proposed.

Parsomnia with continuing danger as a noninsane automatism: forensic aspects of violent NREM and REM sleep parasomnias

As pointed out by Broughton et al. in the Parks case, the legal concept of noninsane automatism in Canada "embraces two further policy components, the intent of each being the protection of the public" (1). One concept is continuing danger: "any condition likely to present a recurrent danger to the public should be treated as insanity" and then the accused must undergo mandatory hospitalization for an indefinite period of time. We believe that it would be very inappropriate to consider somnambulism (or any parasomnia) with continuing danger as an insane automatism requiring indefinite psychiatric hospitalization. Instead, a parasomnia with continuing danger should be regarded as a noninsane automatism requiring nonpsychiatric partial hospitalization for the express purpose of moni-

toring overnight sleep until the parasomnia can be reliably controlled with treatment.

Violent NREM sleep parasomnias

One argument used in the Parks case to help render the verdict of minimal risk for recurrent danger was that "there are no documented cases of repeated violent somnambulism in the literature, so that recurrence, in general, must be exceptional" (1). Nevertheless, there are at least five published reports (involving 13 patients) in the medical literature of PSG-documented. injurious NREM sleep parasomnia with recurrent aggression and violence directed toward others (7,12,19–21), which would strongly support the proposed medical–legal concept of "parasomnia with continuing danger as a non-insane automatism". In all these reports, with perhaps one exception (21), violence toward another person took place during frank somnambulism.

The first report involved a 27-year-old man with a 10-year history of repeatedly violent somnambulism in which "his violent striking out had hurt his wife on a few occasions and he feared he might seriously injure their newborn child" (19). A psychiatric disorder was not present. The second report involved a 25-year-old woman with a 12-year history of violent somnambulism with "hitting and kicking family members" (20). Apart from a "mild depressive reaction", there was no psychiatric history. The third report involved a 64-year-old man with a 1-year history of NREM sleep parasomnia with "two attempts to strangle his wife" (21). Slow-wave (stage 3/4) sleep was elevated for age in that case. Extensive evaluations did not detect any psychiatric, medical or neurologic disorder. The fourth report involved a man whose wife reported that "He seems to have the strength of 10 men and shoots straight up from bed onto his feet in one motion. He's landed clear across the room on many occasions. . . . He's grabbed me and pulled on me, hurting my arms, because he's usually dreaming that he's getting me out of danger of some sort. . . ." (7). The fifth report described a young adult man, who "imagining that his father was being electrocuted, raced into the father's room and tossed him from his bed. On another occasion, believing that his bed-partner was being attacked by an intruder, he beat her with his fists" (12). In the latter report, there was mention that in eight of the 10 patients "self-injury or striking of objects or other persons was characteristic. . . . Object-directed violence could also occur during the episodes, often in response to the perceived threat" (12).

There are at least nine other cases involving presumed NREM sleep parasomnia (PSG studies were not conducted) associated with recurrent aggression and violence toward others (22–30). These patients (aged 22–65 years; seven males) had engaged in the following injurious, sleep-related acts directed at spouses and others: axe blows to the head, resulting in accidental death (n = 1); stabbing (n = 1); choking/strangulation (n = 4); and "violent physical assaults", beatings with punching and kicking, with one spouse sustaining a punctured eardrum (n = 7). In at least five of the nine cases just cited, repeated violence toward another person occurred during frank somnambulism (22–24, 27–29), whereas in at least one case (26), and apparently in three other cases (25,30), violence occurred during bed-confined "confusional arousals" from slow-wave sleep, a recognized diagnostic entity (8).

In 1989, our center reported on 54 adults with long-standing somnambulism and/or agitated sleep terrors that had resulted in repeated injuries (e.g. fractures, lacerations, and ecchymoses), usually from violent activity that occurred 1–7 nights weekly, and often multiple times nightly, and nearly all these patients had unequivocal PSG-behavioral documentation of a NREM parasomnia (7). None of these clinical cases involved any alleged criminal act or any form of litigation. Most of these patients responded promptly (i.e. within several weeks and usually within 1 week), and in sustained fashion for years (7,31), with treatment consisting of low to moderate doses of a bedtime benzodiazepine, usually clonazepam. Parasomnia relapses occurred whenever patients neglected to take their medication. Therefore, injurious NREM sleep parasomnias in adults may be more prevalent than previously recognized and can persist unabated or become progressively more severe over time. Spontaneous remission among the patients referred to our center is quite rare.

Violent REM sleep and other parasomnias

A review of the worldwide medical literature on REM sleep behavior disorder (RBD) (32), a REM sleep parasomnia (8), provides another compelling scientific basis for formulating the medical–legal concept of "parasomnia with continuing danger" as a noninsane automatism. Table 2 summarizes findings from 12 reports on 22 patients with RBD who had repeatedly (≥2 times) injured their spouses while in bed during sleep due to violent dream-enacting behaviors (14,33–43). The risk of lethality from RBD was considered to be particularly high in five cases.

Another parasomnia, "episodic nocturnal wanderings", is characterized by complex and violent behaviors with ambulation that commonly result in major injuries to the patients (44), but spouses have also been the object of repeated aggression [e.g. "patient 12 would drag his wife around the bedroom by her hair" (45)].

TABLE 2. *Published cases of polygraphically-documented REM sleep behavior disorder in which spouses of patients had been repeatedly beaten and injured during violent dream-enactment[a,b]*

			Violent sleep-related behaviors[b]		
Reference	n	Gender (Spouse-Victim)	Punching (and kicking)	Choking/headlock	Duration (years)
Schenck et al. 1986 (33)	4	n = 4 female	n = 4	n = 2 (pts. #4, 5)[c]	.33–6.0
Schenck et al. 1987 (34)	2	n = 2 female	n = 2	—	5.0 and 5.0
Schenck et al. 1988 (35)	1	n = 1 female	n = 1	n = 1 (pt. #1)[c]	24.0
Culebras and Moore 1989 (36)	3	n = 2 female	n = 2[c]	—	2.0 and 2.0
		n = 1 male	n = 1	—	2.0
Mahowald et al. 1990 (14)	1	n = 1 female	n = 1	—	5.0
Wright et al. 1990 (37)	1	n = 1 female	n = 1	n = 1[c]	10.0
Tachibana et al. 1991 (38)	1	n = 1 male	n = 1	—	3.0
Schenck et al. 1992 (39)	1	n = 1 female	n = 1	—	1.0
Schenck and Mahowald 1992 (40)	4	n = 3 female	n = 3	n = 1[c]	3.0
					n = 2 not stated
		n = 1 male	n = 1	—	1.0
Silber and Ahlskog 1992 (41)	2	n = 2 female	n = 2	—	3.0–4.0
Bamford 1993 (42)	1	n = 1 female	n = 1	—	7.0
Louden et al. 1994 (43)	1	n = 1 male	n = 1	—	Not stated
					Duration, mean ± SD:
Totals (n = 12 reports)	22	n = 18 female (81.8% female)	n = 22 (100%)	n = 5 (22.7%)	4.7 ± 5.2 years (n = 19)

[a] Mean age of patients, 62.5 ± 14.0 years (n = 20; n = 2 did not have a stated age). Ages of the spouse-victims were not stated, but presumably are comparable to the ages of the patients.

[b] Injuries sustained by spouses: lacerations, ecchymoses (including facial and periorbital), muscle contusions, cervical trauma, various musculo-skeletal injuries, post-traumatic headaches persisting for days.

[c] The risk for (unintentional) lethality was especially high in each cited instance of choking, headlock or punching.

In one report with PSG monitoring, two episodes were documented that arose from stage 2 NREM sleep (45).

CONCLUSIONS

Violence associated with parasomnias in adults can result in repeated self-injury and in injury to the bed partner that can be recurrent, and at times potentially lethal. Furthermore, on account of state and trait factors affecting the spouse (e.g. small body size/slight build, bleeding disorder, anti-coagulant therapy, pregnancy, injury, cardiac or other illness, psychiatric disorder, etc.), a major (even lethal) injury or illness exacerbation can occur with only moderate aggression. Both clinical and medical–legal assessments of ongoing risk to the bed partner must consider not only the previously demonstrated force and intensity of the parasomnia behaviors on the part of the patient, but also the degree of vulnerability to injury of the victimized spouse (which also includes the position in which the spouse is sleeping alongside the patient).

One can thus predict that there will be forensic parasomnia cases in which the most prudent clinical and legal/public safety course to follow would be to PSG-monitor the sleep of the accused each night at an experienced, accredited sleep disorders center until the diagnosis is established, and other possible diagnoses are excluded. The accused could then be confined on a nightly basis in an observation unit, with audiovisual recording of overnight sleep, until determination of the proper dose of a benzodiazepine [such as clonazepam for RBD (31,32,46) and for somnambulism (7,31), or other medication] for the reliable suppression of the clinically symptomatic and potentially dangerous parasomnia behaviors. At that time, the patient can be regarded as no longer being a menace to public safety and can be discharged from overnight hospital confinement. Ongoing outpatient treatment other than medication would include proper sleep/wake hygiene (47) and avoidance of identified risk factors [e.g. sleep deprivation, physical overexertion, major stress and inappropriate use of alcohol (48)]. Hypnosis may also be used (49).

Note added in proof: Two additional cases have recently been reported in which males with RBD repeatedly attacked their spouses during sleep (50,51): one spouse had sustained several injuries and was nearly strangulated on one occasion; another spouse was struck on the head on numerous occasions.

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