

Carlos H. Schenck,¹ M.D.; Samuel Adams Lee,¹ B.A.; Michel A. Cramer Bornemann,² M.D.;
and Mark W. Mahowald,² M.D.

Potentially Lethal Behaviors Associated With Rapid Eye Movement Sleep Behavior Disorder: Review of the Literature and Forensic Implications

ABSTRACT: Rapid eye movement (REM) sleep behavior disorder (RBD) is characterized by loss of the muscle atonia of REM sleep, with release of complex and violent behaviors that are often attempted dream-enactments. This study reviewed the literature on RBD with regard to potentially lethal behavior. A total of 39–41 clinical cases of RBD associated with potentially lethal behaviors to self and/or others were found, involving a child and adults of all age groups, that manifested as choking/headlock ($n = 22$ – 24), defenestration/near-defenestration ($n = 7$), and diving from bed ($n = 10$). A total of 80.8% ($n = 21$) were males; 19.2% ($n = 5$) were females; mean age was $65.6 \pm$ (SD) 13.8 years (range: 27–81 years, and a child). (Gender/age data were not listed in the remaining cases.) An etiologic association of RBD with a neurologic disorder (or with pharmacotherapy of psychiatric disorders, $n = 4$) was present in 21–23 patients. Thus, RBD carries well-documented, potential forensic consequences during RBD episodes that could possibly have been misinterpreted as suicidal or homicidal behavior.

KEYWORDS: forensic science, forensic sleep medicine/parasomnia pseudo-suicide, rapid eye movement sleep behavior disorder, parasomnia, polysomnography, sleep disorders, sleep related injury/sleep violence, neurologic disorders, geriatric medicine, dreams/dream-enactment/oneirism

The term “parasomnia” refers to a group of conditions associated with complex behaviors and experiential phenomena arising from the sleep period, occasionally resulting in injurious and violent behaviors with forensic consequences. The most common parasomnias of forensic interest are: (i) the disorders of arousal (confusional arousals, sleepwalking, and sleep terrors) and (ii) the rapid eye movement (REM) sleep behavior disorder (RBD).

As mammals, we spend our lives in three states of being: (i) wakefulness, (ii) nonrapid eye movement (NREM) sleep, and (iii) REM sleep. Each of these states is comprised of a large number of physiologic variables which typically occur in concert, resulting in full declaration of a given state. Importantly, these states are not mutually exclusive, and may become admixed (dissociated) or oscillate rapidly, with dramatic behavioral consequences. The disorders of arousal represent an admixture of wakefulness and NREM sleep, whereas RBD represents admixture of wakefulness and REM sleep (1).

Disorders of arousal are by far the most common parasomnia associated with forensic consequences. Violent or criminal acts committed during sleepwalking or confusional arousals are explained by preservation of motor activity during NREM sleep with deactivation of cortical regions normally associated with monitoring and remembering behavior—permitting complex behaviors

without conscious awareness, and therefore without culpability. These behaviors may be extremely complex and protracted: sleepwalkers may end up outside their home, and may walk long distances or even drive automobiles during an episode. During these spells, the individual may appear to be awake, but if awakened, is often confused and disoriented, and usually does not remember a complex dream plot. Disorders of arousal as criminal defense have been thoroughly reviewed elsewhere (2).

In contrast, complex behavior associated with RBD occurs during REM sleep. One of the defining features of REM sleep is active paralysis of all somatic musculature (except the diaphragm to permit respiration). RBD is characterized by the abnormal absence of REM sleep atonia, permitting “acting-out of dreams.” Unlike disorders of arousal, RBD behaviors tend to be quick and brief. If awakened, the individual is usually fully alert and oriented, and can most often remember dream mentation that closely correlates with the observed behavior.

The eyes are usually closed in RBD, as the dream-enactor is attending to the dream environment rather than to the bedside surroundings. Tremendous strength can be demonstrated during RBD episodes, both spontaneously during dream-enactment and also in response to the spouse shaking, grabbing, or yelling at the patient while attempting to abort an episode, which can exacerbate the level of violence before awakening occurs (3). Patients with RBD are not more aggressive in their waking personality compared to controls, despite having significantly more aggressive dreams with dream-enacting behaviors (4). RBD behaviors are usually confined to the bed or the bedroom.

The causes of sleep-related injury and violent parasomnias, with forensic implications, have been documented by means of specialized clinical evaluations and extensive, hospital-based

¹Minnesota Regional Sleep Disorders Center, Department of Psychiatry, Hennepin County Medical Center and University of Minnesota Medical School, Minneapolis, MN 55415. [SAL, research assistant.]

²Minnesota Regional Sleep Disorders Center, Department of Neurology, Hennepin County Medical Center and University of Minnesota Medical School, Minneapolis, MN 55415.

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“video-polysomnography” (vPSG) (5,6). These conditions are more prevalent than previously thought: disorders of arousal occur in 4–5%, and RBD in 0.38–0.5% of the adult population (7,8).

When the worldwide literature on RBD was first reviewed in 1995 (9), 9 years after its formal discovery in 1986 (10), there were 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. The risk of lethality from RBD was considered to be especially high in five of those cases. These documented cases of RBD provided another compelling scientific basis, besides recurrent violence with sleepwalking, for the medical-legal concept of “parasomnia with continuing danger” as a noninsane automatism (9). The worldwide literature on RBD has been expanding exponentially (11), and the relevance of RBD is recognized across clinical and scientific disciplines. For example, RBD is often a harbinger for the future emergence of a parkinsonian disorder, and is also commonly associated with narcolepsy (12–14). Experimental animal models of RBD exist (in cats and rats), involving brainstem lesions that demonstrate how RBD results from both loss of REM-atonía and disinhibition of motor-behavioral pattern generators, which explains how neurophysiologic dysfunction (rather than psychopathology or criminality) accounts for the release of violent and other complex behaviors found in human RBD (13). We now review the cumulative literature on RBD with regard to potentially lethal behavior and recurrent violence and injury to self and bed partner, and discuss the forensic implications.

Methods

A computerized literature search was conducted to identify all publications on RBD in humans, both in English and in foreign languages, since 1986 when RBD was formally identified and named (10). In addition, two books written by one of the authors (CHS) in which 27 of his patients with RBD shared their clinical histories (edited transcriptions of recorded clinical interviews), often with their spouses, were reviewed to identify cases for this study (3,15). The initial screening of these publications by two of the authors (CHS, SAL) was focused on finding descriptions of RBD behaviors, their longitudinal course, frequency of recurrence, level of severity (including injuries), and potential lethality to self and others. Other pertinent information, such as co-morbidity with neurologic disorders and medication-induced cases, was also extracted from each of these reports. After consensus was reached by these two authors, the other two authors (MACB, MWM) reviewed and agreed with the literature extraction and data analysis, and provided pertinent clinical and forensic input. Most of the diagnosed cases of RBD were confirmed by vPSG, in accordance with current recognized criteria (16), although some cases satisfied earlier diagnostic criteria not requiring vPSG monitoring (17). Patients with the “parasomnia overlap syndrome” (characterized by clinical and PSG features of both disorders of arousal and RBD) were included (18).

Diagnostic criteria for RBD contained in the ICSD-2 include:

- Presence of REM sleep without atonia: the EMG (electromyographic) finding of excessive amounts of sustained or intermittent elevation of submental EMG tone or excessive phasic submental or (upper or lower) limb EMG twitching.
- At least one of the following is present: (i) sleep-related injurious, potentially injurious, or disruptive behaviors by history and (ii) abnormal REM sleep behaviors documented during polysomnographic monitoring.

- Absence of EEG epileptiform activity during REM sleep unless RBD can be clearly distinguished from any concurrent REM sleep-related seizure disorder.
- The sleep disturbance is not better explained by another sleep disorder, medical or neurologic disorder, mental disorder, medication use, or substance use disorder.

Results

Table 1 lists, by behavioral category, the 39–41 identified cases (involving 34–36 separate patients) of RBD associated with potentially lethal behaviors to self or others, involving a child and adults of all age groups. Dream-enacting behaviors with RBD were explicitly described in 27 patients. Gender was mentioned in 31 cases and age in 30 cases that involved 26 patients (three patients each had potentially lethal behaviors in two categories, and one patient in three categories). There were 21 (80.8%) males and five (19.2%) females; mean age \pm SD was 65.6 ± 13.8 years (range: 27–81 years, and a child). An etiologic association of RBD with a neurologic disorder (or with SSRI/other pharmacotherapy of psychiatric disorders, $n = 4$) was present in 21–23 patients, with uncertain association in six patients, and no association in seven patients (“idiopathic RBD”). Parkinsonian disorders were causally associated with RBD in 9–11 cases (Parkinson’s disease [PD], $n = 5$ –7; dementia with Lewy bodies [DLB], $n = 2$; multiple system atrophy [MSA], $n = 1$; Shy-Drager Syndrome, $n = 1$), followed by stroke/cerebrovascular disease, $n = 4$; dementia, $n = 2$; narcolepsy, $n = 1$; and multiple sclerosis, $n = 1$. All the reported cases were clinical, and not medical-legal, cases.

Choking/Headlock (Bed Partner/Caregiver)

A 27-year-old deaf psychologist reported that “I think the first time was when I dreamed that the fish were the devil. A woman wanted to shoot me. I started wrestling; then she pulled a gun on me and I finally succeeded. I woke up and I had my wife in a headlock and I had her arms pinned behind her back and she couldn’t move, and I pulled out a big chunk of her hair in the process...I could have choked her and broke her neck...The fact that I’m deaf makes it even more difficult for waking up. But, even before I had lost my hearing, I was just totally hard to wake up” (3) (RBD story IX). A 45-year-old man with RBD-narcolepsy reported putting a “hammerlock” on his spouse during his dream-enacting episodes (19). A 60-year-old man with RBD-MSA had nocturnal episodes in which “his spouse had sustained several injuries including one apparent attempt at strangulation” (20). A 63-year-old man with RBD and delayed-onset Shy-Drager Syndrome reported “a progressive 10-year history of abnormal behavior during sleep. He would at various times choke, kick, punch, and spit on his wife while he was asleep. In addition, complex behaviors such as getting out of bed and running into walls while asleep were reported by family members. This behavior occurred while the patient was dreaming, usually of being attacked. The episodes...occurred approximately twice per week. The problem was severe enough that the patient had taken to tying himself into bed with a rope while his wife slept in another room for her safety. Despite these nighttime episodes, there was no change in waking behavior; he was described as a loving and caring husband and father and retained his job as a public relations executive” (21).

A 64-year-old man with a 6-month history of RBD had “1 occasion...of punching and attempting to strangle his bed partner. Since that night, they have lived in separate houses, his bed partner

TABLE 1—Cases of RBD* associated with potentially lethal behaviors, usually during dream-enactment.

Nocturnal (RBD) Behaviors	Gender	Age (years)	Duration, RBD (years)	Clinical Disorder [†]	References
Choking/Headlock (bed partner/caregiver)	Male	27	2.5	—	3
	Male	45	4.0	Narcolepsy	19
	Male	60	3.0	Multiple system atrophy	20
	Male	63	10.0	Future Shy-Drager syndrome	21
	Male	64	0.5	—	22
	Male	65	7.0	Future Parkinson's disease	3,12
	Male	67	27.0	Future Parkinson's disease	3,12,23
	Male	67	3.5	? (Uncertain)	3
	Male	68	5.0	Alzheimer's disease	24
	Male	69	4.0	Parkinson's disease	25
	Male	69	7.0	—	15
	Male	70	0.3	Dementia	10
	Male	70	6.0	Stroke	3,10
	Male	72	17.0	Dementia with Lewy bodies	26
	Female	72	10.0	—	27
	Male	77	7.0	Dementia with Lewy bodies	28
	?	?	?	?	29
	?	?	?	?	29
	?	?	?	Parkinson's disease (≤3 cases)	30
	Female	?	?	Psychiatric disorder	31
?	?	?	Psychiatric disorder	31	
?	?	?	Psychiatric disorder	31	
Defenestration	?	(child)	?	?	32
Near-defenestration	Male	27	2.5	—	3
	Male	67	27.0	Future Parkinson's disease	3,12,23,33
	Male	67	5.0	Future Parkinson's disease	25
	Male	70	6.0	Stroke	3,10
	Male	80	(several years)	—	34
	?	?	?	?	29
Diving from bed (into furniture/wall/floor)	Female	25	0.5	Multiple sclerosis	35
	Male	65	7.0	Future Parkinson's disease	3,33
	Male	70	2.0	Cerebrovascular disease	3
	Male	70	6.0	Stroke	3,10
	Male	73	5.0	—	6
	Male	73	2.0	Cerebrovascular disease	36
	Male	73	10.0	—	37
	Female	74	4.0	SSRI-induced	‡
	Female	81	(immediate)	Stroke	38
	?	?	?	?	29

*Rapid eye movement sleep behavior disorder.

[†]Etiologic link with RBD (neurologic disorders or pharmacotherapy of psychiatric disorders).

[‡]New case reported in this manuscript (medication-induced RBD) (SSRI: serotonin-specific reuptake inhibitor, as therapy of major depression).

having moved back in with her mother for fear of her personal safety” (22). A 65-year-old man with idiopathic RBD and future PD (3,12) reported that “Before she [wife] quit sleeping with me, I got a headlock on her one time. I thought I was wrestling someone and I had her by the head” (3) (RBD story XVIII). His wife responded: “You scared me. I didn’t think I was going to get you awake...He had his arm around me like a headlock and I was afraid I was not going to get him awake.” The husband then commented that “What scares me is what a catastrophe that would be to wake up and find that I had broken her neck. I’m pretty strong in the arms and hands, and they could charge me with murder. I would be absolutely oblivious of what I’d done.” Furthermore, “I was always afraid that when she might grab me, I would think that it was the attacker in my dreams grabbing me and I might haul off and paste her in the head.” Wife: “What happens to people like my husband who don’t get diagnosed? Did they kill their wives in these experiences, do we know?”

A 67-year-old man with idiopathic RBD and future PD (3,12,23) remarried “and his second wife immediately noticed his wild sleep behaviors. In one episode, he put her head in an armlock and punched her repeatedly while he was dreaming” (23). When the patient described “pounding on her head” one night, his wife

commented that “He was trying to beat me up. He was holding my head like this (arm all around her head). I couldn’t get out” (3) (RBD story XX). The patient commented that “I haven’t dreamt of that gorilla for a long time. I hope that he is gone.” However, he further elaborated that “in the last year or so, we were down in Iowa visiting some folks and...during the night I got her head under my arm and was beating the dickens out of her with my other hand. I heard her crying, but I didn’t wake fully...I must have been dreaming that I was in a fist fight with somebody. This happens quite often and she has to suffer for it...I just accepted me for what it was. I felt bad when I would abuse my wife, but I did it in my sleep so there was nothing I could do about it.” A 67-year-old man with RBD developing after hip surgery had his wife report that “One time he tried to choke me...It was very frightening because I was saying, ‘Honey, wake up, wake up!’ It didn’t seem for a minute like it was registering until I had to raise my arms up and almost smack him on the chin. It frightened me so much. I just finally hollered loud enough that it woke him up and I shoved my hand up against his chest, and more-or-less broke his grip” (3) (RBD story XXII). Furthermore, in response to the question “Has he ever hit you?” the wife replied: “Yes. One night right in the jaw. A punch coming out of a sound sleep—it was really an

eye opener. He has hit me in the back, grabbed me by the arms, and things like that. I was black and blue all over. He doesn't realize he's doing it, and I've really had to shake him hard to wake him up" (3).

A 68-year-old man with dementia (probable Alzheimer's disease) during 5 years experienced a "progressive problem with intrusive, violent dreams, which he enacted with injury both to himself and to his wife. His wife described violent limb movements and shouting and gave examples of being strangled and of the patient throwing himself out of bed" (24).

A 69-year-old man with RBD-PD "on one occasion...dreamed that he was struggling with a robber, and he was punching and squeezing his spouse's neck. The frequency of these complex movements during sleep averaged once or twice a week" (25). A 69-year-old man with idiopathic RBD recalled that "When I choked my wife, I think I was dreaming about getting rid of an animal" (15). His wife commented that "The best I can describe is that he would literally go wild at night...The scariest of all was the time he had his hands around my throat and was actually choking me. That, of course, is something I'd never forget because that feeling of having pressure on your neck is terrifying. It was never easy to wake him up. I could get him to stop, but it was hard to get him fully awake. He would go right back to dreaming in no time."

A 70-year-old man with RBD and dementia "While moaning...would punch and kick his wife during as many as five distinct episodes within any given night. There were never more than 3 consecutive nights without such activity. On another occasion he attempted to strangle his wife while dreaming of fending off a mauling bear...There was no psychiatric history; his wife commented on his gentle nature" (10). A 70-year-old man with RBD triggered by a subarachnoid hemorrhage (3,10) had "Violent sleep behaviors initially...once weekly but eventually occurred four times weekly...Once he grabbed his wife's neck with both hands while dreaming that he had just staggered a deer with a blow to its head and was going to break its neck, which was, in fact, his wife's neck" (10). When his wife hollered at him, the patient awoke and explained, "I was going to break that deer's neck. Just think what would have happened if you wouldn't have hollered" (3) (RBD story III). A 72-year-old man with RBD and dementia (most likely DLB) had longstanding "progressive abnormal behavior and violence during sleep leading to falls, ambulation, and self-injury. He had a history of attacking his wife (who now slept in another room) and of attempting to choke her during sleep. She had difficulty controlling him until he 'woke up', at which time he immediately resumed his usual placid nature" (26).

A 72-year-old Chinese widow without prior parasomnia history developed a 10-year history of "sleepwalking...and 'speaking foul language and yelling during sleep,' while having 'vivid and frightening dreams, frequently of being chased...As she used to sleep with her 3-year-old grand-daughter, she was at times awakened by the child's crying as her grandmother slapped her on the face...One night, she dreamed of defending herself against an enemy and was suddenly awakened by her grand-daughter's screaming. Madam A was grabbing the child's neck and trying to strangle her. The patient was shocked and horrified by her own behavior and...from then on, she slept on her own" (27).

A 77-year-old man with RBD and DLB "On one occasion...held his wife's head in a headlock and, while moving his legs as if running, exclaimed, 'I'm gonna make that touchdown!' He then attempted to throw her head down toward the foot of the bed. When awakened, he recalled a dream in which he was running for a touchdown, and he spiked the football in the end zone. His wife had endured numerous bruises and pulling of her hair" (28).

In a series of 93 patients with RBD, "Thirty patients (32%) reported injuries to themselves during sleep (17 while falling out of bed, 15 by striking or bumping into furniture or walls). Injuries included lacerations or ecchymoses to the head or face in at least 10 patients...One patient kicked a hole in the bedroom wall and **one attempted to leap through a window**. Also, one patient fired an unloaded gun, while another attempted to set fire to his bed. **Subdural hematomas occurred in two patients, one related to motor activity in sleep** and one of uncertain cause...(64% of 83 patients with sleeping partners) reported being assaulted; 13 reported injuries caused by punching, slapping, kicking, pulling of hair and **attempted strangulation (two spouses)**. One spouse required dental work, one was injured by a falling vase and one by a falling picture. Twelve spouses (15%) chose to sleep in separate rooms and one patient constructed a plywood barrier to separate himself from his wife. Sixty-two of 67 patients reported dreams associated with motor activity" (29). (Bold text indicates the links to Table 1).

A report on a series of RBD-PD patients described that "In the RBD group [$n = 9$; 7 males], a variety of nocturnal behaviors were reported by the caregivers. These behaviors occurred from once per month to more than once per week and were described as running movements, pushing and kicking movement, punching or **choking the caregiver**, and thrashing. There were frequent vocalizations during these events. If awakened during an episode of abnormal sleep behavior...all recalled violent dreams at the time of awakening, including being pursued by an enemy, trying to protect family members from unknown intruders, or fighting off unidentified assailants" (30). (Bold text indicates the link to Table 1).

A report on parasomnias systematically identified in an outpatient psychiatry clinic in Hong Kong included four cases of severe bed partner injury (31). Three of these cases involved attempted strangulation of the bed partner by patients with documented RBD, and in one case the following scenario occurred: a woman with RBD discovered that her husband was having an extramarital affair, which enraged her, and so one night while sleeping with her daughter she had a dream-enacting episode in which she was retaliating against her unfaithful husband by strangulating him, but in reality she was strangulating her daughter in bed (Y.K. Wing, personal communication).

Defenestration

A child with RBD had a life-threatening episode, associated with a nightmare, with "Running through a 2nd floor window, fracturing pelvis and both femurs" (32). Age, gender, and duration of RBD were not mentioned, nor whether the child had idiopathic RBD (found in four of five cases) or narcolepsy-RBD (found in one case). Mean age for the group of five children with RBD was 9.0 ± 4.2 years.

Near-Defenestration

A 27-year-old man described in the previous section on choking/headlock also had many RBD episodes involving "diving out of bed," and he commented that during one episode "Just recently, I broke the window..." (3) (RBD story IX). A 67-year-old man described in the previous section on choking/headlock (3,12,23) had his wife describe that during his longstanding course of RBD, "He has jumped [from bed] and landed right in the middle of the floor, right by the table" (3) (RBD story XX). The patient

commented that “One time when I was sleeping on the same side of the bed, I jumped out of the bed. Now I didn’t know this until I hit the floor and she woke me up, but there are windows on that side, and a serving cart that she puts her plants on. I may have jumped right out the windows if it hadn’t been for the serving tray stopping me.” As an example of the great force generated by his RBD episodes, “One time I was sleeping on one side and I jumped into the walk-in closets and I knocked the doors right off the adjustments, the hinges or whatever holds them.”

In another case involving RBD and future PD, “A 67-year-old man had a 3-year history of progressive stiffness and slowing of his left side. Five years before the onset of these symptoms, he began having vivid dreams together with violent movements during sleep. Once he dreamed of being trapped in a house on fire, and he almost jumped out of the window, if not for his wife awakening and restraining him” (25). A 70-year-old man with stroke (subarachnoid hemorrhage)-induced RBD described in the previous section on choking/headlock (3,10), also described two episodes of near-defenestration (3) (RBD story III): “Say that our bed is right here and there is one of those big sliding windows over there, almost as wide as that wall. Somebody was after me and I figured my only escape was to jump through that window and get away from them. So I got up and I jumped and I missed the window by about 8 inches and I hit that wall, and the dent is still in there like a soup bowl.” In the second episode, “One time I said, ‘I have to get these guys quick because they are going to be leaving.’ I was going to jump out the window. I missed the window by eight inches and went head-first into the wall and skinned the whole front of my face and loosened up my teeth, and this foot I drove under the baseboard radiator heater it looked like you took a hatchet and chopped my foot open.”

An 80-year-old internist with idiopathic RBD presented with a complaint of acting-out his dreams for several years, at times with vigorous kicking and punching, as reported by his wife. “She reported that he once repeatedly punched her while screeching loudly; more recently, he hurt himself when he crashed head-first into the bedroom window while apparently ‘sleepwalking.’ He sustained a significant facial injury from this and subsequently decided to restrain himself to his bed to prevent future episodes” (33). In the series of 93 RBD patients described in the previous section on choking/headlock, one of the patients had attempted to leap through a window during an RBD episode (29).

Besides the cases of defenestration/near-defenestration listed in the table, there are three other pertinent cases. First, the wife of the 69-year-old man with idiopathic RBD described in the previous section on choking/headlock also mentioned that “We had a bay window in our bedroom, and one of our daughters...used to worry that her dad would jump out the window, which would have been possible. He would’ve fallen out on the cement driveway. The other thing I worried so much about was that he did have guns for hunting. I was so afraid that he would get up and get a gun and probably shoot us, so I talked him into selling his guns. I never did hide the knives, but when he was having his strongest episodes, I worried about it. But he was always trying to protect me...people trying to get in our house. He thought they were coming up the stairs, and he jumped out of bed a few times. He would hit a piece of furniture and end up with black and blue spots” (15). Second, the wife of a 72-year-old man with idiopathic RBD (3) (RBD story IV) wrote an essay on being the spouse of a man with RBD, entitled *A Bedpartner’s Nightmare* (3), and reported that “...we got rid of the high bed and got the low bed frame, and there was one dresser in there that had sharp corners and I took it out. Our windows are such that...he’d have to climb up pretty high. If he goes out

the window, that would be scary.” Third, a 65-year-old man with a 20-year history of idiopathic RBD and future PD had his wife describe many episodes of diving from bed and demonstrating tremendous strength during dream-enactment, including “One night he turned in the bed and put his feet up against the window and broke the window...he pushed with such force while he was dreaming” (3) (RBD story XVII).

Diving from Bed (Into Furniture/Wall/Floor)

A 25-year-old woman with multiple sclerosis “presented with a 6-month history of sudden awakenings from fearful, often vivid... dreams and with terrified screams or violent behavior such as kicking, running to the door or to the window, crying and falling out of bed. If awakened, she always recalled a fighting dream. Once she repetitively banged her head against the floor, inducing a large facial hematoma. On that occasion, she was dreaming that a man was knocking her against the wall” (34).

A 65-year-old man with idiopathic RBD and future PD (3,12) described in the previous section on choking/headlock, also described the following dream-enacting sequence: “I thought I was with a childhood chum, and we were standing on the wing of an airplane...I remember hollering, ‘Get the hell out of here,’ and we just dove head-first off the wing, but what I actually did was dive head-first over the end of the bed with the blankets, pillows—everything going with me. There’s a vanity sitting there and I just scraped the edge of that vanity with the side of my head and ear...It woke me immediately and I thought, ‘Oh my God, if I would have hit that vanity with my forehead, I would have either caved it in or I’d have broken my neck.’ That scared me because I hit my head and shoulders right at the foot of the vanity” (3) (RBD story XVIII).

A 70-year-old man with RBD associated with cerebrovascular disease described how “I’ve fallen out of bed at least twice and with one of those dreams, I was swimming, floating on my back and then decided...to do...a flip, under the water. But I just went right out of bed. I woke up and there I was, cut my head. And the last time that happened, I didn’t remember the dream because I knocked myself out. I’m sure it was a concussion because my wife tells me what I did afterwards and I had no memory of it...Then she asked me a few things like, ‘What day is it? What year is it? And I was way off. I said 1981 [when it was 1986]. So it really frightened me” (3) (RBD story XXI).

A 70-year-old man with stroke-induced RBD, described in the two previous sections on choking/headlock and near-defenestration (3,10), also reported many hazardous episodes from diving out of bed during his 6-year course of RBD, such as: “I was alone in this motel, and God, if I didn’t jump over the end of the bed again, head-first, down on a hard floor...and this foot...hit a formica table...and I split my foot right down to the end...I couldn’t get a shoe on for a couple of weeks...A couple of months ago, I did the same thing at home. I jumped over the end of the bed, the foot of the bed, head-first, came down on the floor, and that left elbow hit the corner of the dresser, I had a big blotch on it. The next night I did the same thing again...The next night I did the same thing again...Three nights in a row. I started tying myself to bed with a rope...The other night when my gal hollered at me, when I was already airborne, I already took the jump, and God, I came close to it. That end table that was there, but I had pushed it just far enough away that my rope didn’t quite reach it” (3) (RBD story III).

A 73-year-old man, married for 46 years, had a 5-year history of RBD with increasingly dangerous dream-enacting behaviors. He often grabbed his wife’s arms tightly and repeatedly kicked

her, and once her ankle remained injured for 2 months. She commented that “he becomes so terribly strong in his sleep.” He frequently fell out of bed and had sustained a 10-cm head laceration after jumping into furniture while dreaming of being attacked by a dog. “His most severe injury occurred...when he dove off his bed into a dresser and lost consciousness for 45 min. He was then hospitalized for 12 days and underwent neurosurgical repair of a fracture through the base of the odontoid process of C2...His wife reported...that his violent sleep behaviors were completely unlike his pleasant waking personality. There was neither a psychiatric history nor a history of childhood sleepwalking or night terrors” (6). A 73-year-old man with RBD associated with cerebrovascular disease reported a 2-month history of headaches, ataxia, and visual blurring, “starting within days of hitting his head on his night table ‘in a dream.’ His wife had noted thrashing and kicking movements in his sleep almost every night for 2 years...Neurology examination showed ataxia and mild confusion. CT scan of the brain revealed bilateral subdural hematomas...He improved neurologically after the subdural hematomas were drained” (35).

Another case of RBD resulting in a subdural hematoma was reported as follows: “We describe a 73-year-old man...with a 10-year history of violent dreams. He stated: ‘I act them out, sometimes I hurt myself...’ His dreams occurred ‘almost every night.’ On occasion, he unintentionally struck his wife. Recently...his wife reported that he jumped off the end of the bed and awoke on the floor with ‘a bloody lip, head, and knee.’ During another episode, the patient leaped from his bed, fell, and struck the right side of his face on a corner of a chest. He immediately awoke and complained of a headache and nausea and vomited. He appeared confused for a 3-h period...A magnetic resonance imaging scan of the brain revealed a left-sided subdural hemorrhage...” (36).

Newly reported case of potentially life-threatening injury from diving out of bed during a RBD episode: A 74-year-old divorced woman presented to our sleep center with a 4-year history of RBD—not associated with dream-enacting behaviors—that had been initially triggered by SSRI medication (fluoxetine) as therapy of major depression. (Initial fluoxetine maintenance therapy was subsequently substituted with sertraline [SSRI] maintenance therapy during her 4-year RBD history.) In a major RBD episode, one night she dove out of bed, hit the corner of a bureau, smashed her face, broke two teeth, which resulted in two black eyes (raccoon eyes), total facial bruising (see photo, Fig. 1), and profuse bleeding, with blood found in multiple rooms (as she had wandered around the house in a daze afterwards). She was taken to the emergency room, where a CT scan of her head was negative. vPSG confirmed the diagnosis of RBD.

In a report on parasomnias in intensive care units (ICUs), “Patient 1 [81-year-old female] developed RBD acutely at the time of a stroke. In the ICU she jumped out of bed and fractured a hip while enacting a dream in which she was escaping from ‘grotesque men with hands like claws and swarms of bees who were attacking me.’ After discharge, her parasomnia [RBD] became progressively severe, with frequent episodes of screaming and jumping out of bed during violent dream-enactment. One episode occurred 3 nights after cataract surgery, when she jumped from bed and punched her cheeks repeatedly, which caused profuse gingival and palatal bleeding. She once bit her husband’s hand during sleep. She had been happily married for 47 years” (37). In that study, as many as half of the 20 patients may have displayed parasomnia behaviors during their ICU confinements (17/20 had RBD). In the series of 93 RBD patients described in the previous sections on choking/headlock and near-defenestration, one of the patients sustained a subdural



FIG. 1—Photograph of a 74-year-old woman with facial and dental injuries sustained from diving out of bed and hitting the corner of a bureau during an episode of REM sleep behavior disorder.

hematoma from colliding into a hard object during a RBD episode (29).

Numerous groups of RBD patients have been reported, totaling nearly 600 cases encompassing idiopathic RBD and various forms of symptomatic RBD (with an approximate 4:1 male–female ratio and mean age predominantly in the 7th decade of life), with aggressive, violent, and injurious RBD behaviors described without sufficient individual identification to allow for inclusion in Table 1 (18,29–32,38–57). However, the major morbidity and potential lethality of the RBD behaviors, along with their longstanding recurrence, was often evident in these publications. For example, in a report on six patients aged 64–74 years, “one patient fractured a hip during an episode, another punched his wife about the head [on repeated occasions and one time] knocking out her dentures, and another broke a tooth while running against the bedroom wall” (39). In a report on RBD and PD, “The worst injuries...included head injuries in three...and bone fracture in one” (39). In another report on RBD combined with sleepwalking/sleep terrors (“Parasomnia Overlap Disorder” [16]) in 33 patients, one patient required emergency surgery for an 80% tear of a triceps muscle, and another for lacerated hand tendons; a total of 18 patients had lacerations, and three sustained fractures (18). Self-protection measures included restraint devices (belts, ropes, dog leashes), padded waterbeds, plastic screens, sleeping on a floor mattress in an empty room, etc.), and spouses sleeping in separate beds and bedrooms (40).

Punching a Pregnant Bed Partner

Although not listed in Table 1 because of insufficient documentation of potential lethality (e.g., lack of specific mention of punching the abdomen of a pregnant spouse), there are two cases involving the punching of a pregnant spouse (or fear of being punched) that raise the specter of violent RBD posing a lethal risk to a fetus. The wife of a 24-year-old man commented that “When I started getting up in the middle of the night to go to the

bathroom after becoming pregnant, one night I went to crawl back in the waterbed when he just sat up real straight and looked me right in the eye and punched me in the face! I knew he wasn't doing it to hurt me—he just thought I was somebody after him in his dream. The look on his face was like he was scared. I was bawling because I was scared to death” (3) (Sleepwalking-RBD Story XXIV). The wife of the deaf psychologist mentioned in the previous section (RBD story IX) on choking/headlock (3) also reported that “One night he sat on me and the reason it was tough was because I was pregnant at the time. I was just so aware of my pregnancy because I didn't want to get punched on the stomach, and get hurt...He's so foreign to anger. Dumb things will make one angry...but I always say he just lets problems come and roll right off him. That's why these dreams are so shocking to me.”

Other Cases

The review of the RBD literature also identified 75 additional individual cases (55 [73.3%] males, 20 [26.7%] females) involving aggressive and violent RBD behaviors (often recurrent and long-standing), but without sufficient documentation to justify a conclusion about potential lethality (22,58–108). Mean ages of the males and females were 61.4 ± 13.6 years (range, 18–88) and 57.1 ± 19.7 years (range, 9–81), respectively. Mean duration of RBD for the males was 8.3 ± 7.0 years ($n = 35$), and for the females was 6.1 ± 8.8 years ($n = 14$) (8 males and 2 females had RBD onset immediately before RBD was diagnosed; 12 males and 4 females did not have RBD duration reported). Injuries to oneself during RBD episodes were reported in 47.3% ($n = 26$) of males and in 55.0% ($n = 11$) of females, and injuries to another person during RBD episodes were reported in 45.4% ($n = 25$) of males and in 45.0% ($n = 9$) of females. Jumping out of bed during RBD episodes was reported in 47.3% ($n = 26$) of males and in 50.0% ($n = 10$) of females. Dream-enacting behaviors with RBD were present in 70.9% ($n = 39$) of males and in 70.0% ($n = 14$) of females. RBD was causally associated with a neurologic disorder in 58.2% of males ($n = 32$; $n = 17$ with parkinsonism and/or dementia), and in 65.0% ($n = 13$) of females, with at least nine categories of neurologic disorders being reported. Idiopathic RBD was present in 29.1% ($n = 16$) of males and in 30.0% ($n = 6$) of females. Medication-induced RBD cases (SSRI therapy of depression, $n = 5$; mirtazapine therapy of depression in parkinsonism, $n = 4$; selegiline therapy of PD, $n = 1$; cholinergic therapy of dementia, $n = 1$) occurred in 20.0% ($n = 11$) of males and in 5.0% ($n = 1$) of females.

In all the RBD cases reviewed herein, as listed in Table 1 and described in the text in publications originating from 19 countries, there was no mention of any case of RBD resulting in marital separation or divorce, or even of marital therapy related to RBD.

Another condition named “Obstructive Sleep Apnea (OSA)-Pseudo RBD” is also associated with violent dream-enactment with major morbidity and potential lethality to self and bed partner (109). However, the parasomnia behaviors do not emerge within REM sleep, as occurs with RBD, but rather during abrupt arousals from REM and NREM sleep triggered by OSA and severe hypopneas. In a series of 16 carefully documented cases with vPSG, the mean age was 59.6 years, and 11 were males, so this group of OSA-Pseudo RBD patients closely matched a typical group of older male RBD patients. Standard therapy of OSA with nasal continuous positive airway pressure fully controlled the OSA and eliminated the violent dream-enacting behaviors, as confirmed by spouse history and repeat vPSG (109).

Discussion

Besides the self-evident potential lethality in some of the cases on account of the resulting injuries, in other cases the violent nature of the RBD behaviors, the great force of impact with hard surfaces, and/or the “near-miss” aspect of certain physical collisions (e.g., alongside windows) indicated potential severe morbidity or lethality. The contrast between the great strength generated during RBD episodes and a neurologic disorder with debilitating features (or diminished strength with advanced age) during wakefulness is remarkable in many of the cases, and serves as an example of “state-dependent behavioral activation” (110). Also, the longstanding history of RBD and the recurrent nocturnal violence in most of these cases should be noted, along with the particular vulnerabilities in individual cases (e.g., deafness; acute stroke triggering RBD in an intensive care unit, with jumping out of bed), and counter-measures taken (e.g., tethering oneself to bed with a rope every night for years). Spontaneous comments are often made by the spouses on how the nocturnal RBD violence is completely discordant from the pleasant and nonaggressive daytime personality. RBD was not causally associated with a psychiatric disorder, apart from one case of SSRI-induced RBD in the therapy of depression.

Our review of the RBD literature has identified a large number of clinical cases involving potential lethality to self and/or bed partner (or caregiver) during RBD episodes. Those episodes could possibly have been misinterpreted as suicidal or homicidal behavior, given the nature of the injurious and violent sleep-related behaviors and the resulting severe injuries, with potential forensic consequences. In patients with clinical depression (and particularly those with suicidal ideation and prior suicide attempts) and coincidental RBD, or those with antidepressant-induced RBD (SSRIs, mirtazapine, venlafaxine, others [111]), RBD episodes and major injuries might suggest nocturnal suicidality. If accidental death were to occur from RBD in this scenario, the coroner possibly would determine that the cause of death was suicide, as reflected on the death certificate, with unfortunate insurance, psychosocial, and religious consequences for surviving family members and friends. Such cases have been termed “parasomnia pseudo-suicide” (112). Furthermore, accidental murder of a spouse (or other bed partner) from RBD could result in arrest and charge of homicide. Also, some cases of choking/strangulation, punching, or other forms of RBD-related violence with serious injury inflicted on the spouse (or other bed partner), might lead to an arrest with a charge of attempted murder. (As previously documented in this review, a number of the wives of men with RBD had commented on the forensic implications of their husbands' [recurrent] sleep violence.) Once RBD as a clinical disorder enters the forensic arena, the possibility emerges that the person with RBD may suffer from inappropriate and unfortunate legal consequences. Therefore, our review of the literature with documentation of compelling case examples of RBD with potential lethality and long-standing recurrent violence, should increase awareness that some apparent “suicides” or “homicides/attempted homicides” are the unfortunate, but unintentional, consequence of sleep-related complex behaviors and therefore are without premeditation, conscious awareness, personal responsibility, and legal culpability (6,112). The sleep-related complex behaviors emerging with RBD are prime examples of “state dissociation phenomena” whereby physiologic event markers of one state of being (viz. muscle tone and behavioral expression found in wakefulness) inappropriately intrude into another state of being (viz. REM sleep, with dreaming) to result in a clinical disorder (110), with forensic implications.

Guidelines for the assessment of possible sleep-related violence have been proposed (6), which for RBD are underscored by the

findings of the literature review of RBD contained herein. Slightly adapted forensic guidelines for RBD are as follows:

- There should be reason, by history and/or formal PSG evaluation, to suspect RBD. Similar episodes, with benign or morbid outcome, should have occurred previously.
- The duration of the action is usually brief (seconds to minutes).
- The behaviors are usually confined to the bed or the bedroom.
- The behavior is usually abrupt, immediate, impulsive, and senseless—and without apparent motivation (apart from dream-enactment, an immediate sleep-related motivation without daytime correlate).
- The victim is someone who merely happened to be present (viz., the bed partner), and who may also have inadvertently instigated or escalated RBD violence by attempting to abort a complex/aggressive/violent RBD episode by grabbing, shaking, yelling, or otherwise agitating the person with RBD.
- Immediately upon awakening, there is perplexity or horror, without attempt to escape, conceal, cover-up, or rationalize the action (apart from explaining any dreaming associated with dream-enactment).
- There is amnesia for the event (but not the dream), including lack of awareness of enacted behaviors in the bed or bedroom accompanying any dreaming. (Recall of a complex dream is usually present, unlike the absence of recall of complex dream mentation in disorders of arousal.)
- Polysomnographic evaluation reveals REM sleep without atonia as a persistent abnormality.

Victim Vulnerability Factors

Vigorous RBD behaviors may lead to the same potentially lethal consequences to the patient or bed partner as would violent behaviors, on account of “victim vulnerability factors” that can increase the risk for major morbidity or mortality. Therefore, a “spectrum of vulnerability” can be formulated for RBD (and other parasomnias) whereby at one end of the spectrum is the degree of vigor and violence of the RBD behavior, and at the other end of the spectrum is the degree of medical vulnerability of the victim. Also, the fact that the patient or bed partner is asleep, and in which sleep stage (e.g., REM sleep with generalized muscle paralysis [REM-atonia] in the bed partner, or slow-wave NREM sleep in the bed partner predisposing to an agitated and violent confusional arousal induced by a RBD episode), or if the bed partner suffers from a sleep disorder predisposing to abnormal and potentially violent arousals (e.g., sleep apnea; sleep inertia; confusional arousals, sleep terrors, sleepwalking, etc.) would add an additional sleep-related vulnerability risk factor. There could also be a reflexive, self-defense response induced by a RBD episode immediately upon the bed partner awakening. The circumstances of the bedside (or other mode of sleeping, such as camping) environment may also confer additional vulnerability. Some of the medical factors that can increase the risk for injury or death from vigorous or violent RBD behaviors include: pregnancy; deafness; blindness; osteopenia/osteoporosis; hemophilia/other bleeding disorder/anticoagulant therapy/aspirin prophylaxis; status post surgical procedure (spinal, head, eye, cardiac, abdominal, etc.); spinal-vertebral disorder; and various advanced age-related vulnerabilities. For example, as stated by Gross (36): “Chronic subdural hematomas (CSH) tend to occur after repeated low velocity blunt head trauma, and are more common in the elderly, who have cerebral atrophy. RSBD may result in blunt head trauma, and RSBD occurs in a population group (elderly males) that is at risk for CSH. The occurrence of both RSBD and CSH in the same patient may be more common than is

generally realized. Older patients with unexplained head trauma should be asked specifically about symptoms of RSBD...” This observation is relevant to cases of RBD in the elderly with repeated head trauma to self and/or bed partner.

Psychiatric factors could also play a role. For example, if the bed partner suffers from post-traumatic stress disorder, then a violent “hair-trigger” response upon awakening could be precipitated by RBD behaviors, with rapid, severe escalation of the sleep violence by further agitating the RBD patient.

In 1995, the medical-legal category “parasomnia with continuing danger as a noninsane automatism” was proposed (9). The core concept was that the risk of recurrent sleep violence was not related to the legal concept of “insanity” (which would require psychiatric confinement), but rather to a “noninsane” condition, i.e., a physiologic disorder of sleep (which would require intervention by a sleep medicine specialist). The forensic aspects of the parasomnias have received growing attention, particularly in regards to inadvertent (attempted) murder or suicide associated with sleepwalking, a NREM sleep parasomnia. As with disorders of arousal, RBD should be considered as a noninsane automatism, as individuals with RBD are acting within the bounds of the dream, and are unaware of their surroundings—and therefore could not form intentions or appreciate the potentially criminal nature of the acts.

In conclusion, RBD carries well-documented, potential forensic consequences. Future reports of clinical cases should contain sufficient detail about aggressive and violent RBD behaviors, their longitudinal course, extent of severity and resulting injuries (including risk of lethality to self and others), vPSG findings, comorbidities, and victim vulnerabilities. The database of potential forensic RBD cases will thereby be expanded, which can assist in the advancement of medical and legal education, and in evidence-based, medical-legal services (preferably in the role of *Amicus Curiae*), and scientifically informed judicial decisions.

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Additional information and reprint requests:
 Carlos H. Schenck, M.D.
 Minnesota Regional Sleep Disorders Center
 Hennepin County Medical Center
 701 Park Ave.
 Minneapolis
 MN 55415
 E-mail: schen010@umn.edu