Homicidal Behavior and Sleep Apnea: a Case Report and Medicolegal Discussion

*Eric A. Nofzinger and †Robert M. Wettstein

*Sleep Evaluation Center, Highland Drive Veterans Affairs Medical Center, and Sleep and Chronobiology Center, University of Pittsburgh School of Medicine, Western Psychiatric Institute and Clinic, Pittsburgh, Pennsylvania, U.S.A.; and †Law and Psychiatry Program, University of Pittsburgh School of Medicine, Western Psychiatric Institute and Clinic, Pittsburgh, Pennsylvania, U.S.A.

Summary: This case report documents the use of sleep apnea as a criminal defense for a man who fatally shot his wife during his usual sleeping hours. The defendant, who had severe sleep apnea as determined by a clinical evaluation and a polysomnographic study, admitted to shooting his wife but claimed that he was asleep at the time. Two physicians testified for the defense that the sleep apnea was of sufficient severity that the defendant may have had a confusional arousal related to the sleep apnea in which he could have shot his wife accidentally. Another physician, testifying for the prosecution, found no evidence to support this defense after a review of the patient's history and polysomnographic records and a review of relevant literature which may have linked sleep apnea with sleep-related violence. In this case, there was substantial apparent motive for the murder, including a past history of spousal and child abuse and a note written by the victim around the time of the shooting describing her intention to take the children and leave the suspect. The jury rejected the sleep apnea defense, handing down a first-degree murder verdict. In the discussion, we briefly review medicolegal issues related to the case as well as prospective guidelines for the medicolegal assessment of future cases. Key Words: Sleep apnea—Parasomnia—Homicide—Forensic medicine.

The question of whether sleep apnea can lead to homicide was recently raised during a criminal trial when a man claimed that he fatally shot his wife during his sleep as a result of his sleep apnea. While injurious behavior occurring during sleep is well recognized (1-13), accidental homicide related to a sleep disorder is considered rare (3,6,7,12,13). The most common sleep disorders that have been associated with sleep-related injurious behavior include sleepwalking, REM sleep behavior disorder, and confusional arousals (1,6,7,12). In contrast, there is little information regarding the relationship between sleep apnea and sleep-related violence. In this case study, the defense of involuntary murder related to sleep apnea is described. One of the authors (E.A.N., a psychiatrist certified in sleep disorders medicine) was contacted by the prosecuting attorney's office to review the medical records of the case to estimate the medical likelihood that the shooting was involuntary and related to the defendant's sleep apnea.

CASE REPORT

On December 26, 1993, the defendant, a 37-year-old male laborer, fatally shot his wife. The police were first notified of the incident after 2:15 a.m. on the night of the shooting from a 911 call made by the defendant. He claimed that he went to bed that night at 1:15 a.m. and the next thing that he remembered was being awakened by the sound of a gunshot. On awakening he realized that he had shot his wife. He stated that she had gone to bed over an hour earlier than he had. There was no mention of how long he took to fall asleep or whether he had any unusual experiences prior to sleep onset. Transcripts of the 911 call revealed that the defendant had a clear sensorium at the time he made the call, giving complete information as to his name and address. He admitted during the call that he must have shot his wife. He claimed amnesia for the event.

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Address correspondence and reprint requests to Dr. E. Nofzinger, Western Psychiatric Institute and Clinic, 3811 O'Hara Street, Pittsburgh, PA 15213, U.S.A.
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and stated that he did not know "what he was dreaming". In an interview one month later he claimed that he did not have any recollection of any specific dream content; however, close to 7 months later, he stated that he may have been dreaming about "deer hunting".

Several historical features regarding the incident were noteworthy or unclear. These included: i) the defendant's usual sleeping place either beside his wife in their water bed or on a couch in another room, ii) the usual location of the gun, iii) the apparent lack of effort by the defendant to help his wife following the shooting, iv) the lack of perceived remorse at the time the police arrived and v) the use of a large handgun (.357 magnum) which would require significant manual dexterity to shoot.

The patient had a history of significant and severe daytime sleepiness, work-related accidents secondary to sleepiness and difficulty breathing during sleep for 5–10 years prior to the shooting. While the defendant did have a history of talking in his sleep and sleepwalking as a child, it was noted that there was no adult history of sleepwalking or any other unusual behaviors during sleep. His sleep was reportedly restless and occasionally he would awaken with a choking sensation and run to the door to get some air. He had a history of heavy alcohol use (drinking one case of beer every 2 days) but had reportedly stopped using alcohol in November 1993. No history of other substance or medication use was known.

According to the friends and family members of the victim, the defendant had been abusive in prior relationships, as well as in his current relationship with both his wife and his children. An undated note written by the victim and found in her purse said that she was planning to take the children and leave the defendant after the holidays, consistent with the time of the shooting.

Two months after the homicide, the defendant's physical condition deteriorated to the point that he required an emergent inpatient admission for treatment of anasarca and severe obesity. An electrocardiogram showed right axis deviation and poor R-wave progression, compatible with chronic pulmonary disease. A chest X-ray showed possible cardiomegaly without pulmonary infiltrates. Blood test results included: hemoglobin, 17.8 g; bilirubin, 1.3; LDH, 254 and SGOT, 47. Arterial blood gas results included: pH, 7.31; Pco₂, 75 and Po₂, 42 on room air. The defendant's weight was estimated to be 300 to 350 pounds. His mental status was semiresponsive, although coherent when given oxygen. Tachycardia (110 beats per minute), marked obesity, lymphangiectasia, erythema of the skin of the abdomen, cyanosis, 4+ pitting edema in the legs and anasarca were noted. The clinical impression included: i) sleep apnea syndrome by history, probably to the point where hypoxic encephalopathy and personality changes could occur, ii) chronic respiratory failure, hypoxic and hypercarbic, related to obesity hypoventilation syndrome, iii) chronic obstructive lung disease and iv) anasarca, severe, related to chronic hypoxemia and right ventricular heart failure. A tracheostomy was placed to relieve the sleep apnea syndrome.

**Polysomnography 7 months after the incident**

Sleep studies of the defendant were performed in July 1994 (6 months after the homicide) at the request of the district attorney's office. These studies were performed in the sleep laboratory of the physician (a pulmonologist with certification in sleep disorders medicine) who later would testify as an expert witness for the defense. The defendant's tracheostomy was plugged during the sleep recording. There was no report as to whether a urine toxicology screen was performed. The defendant's waking breathing function revealed hypoventilation with oxyhemoglobin saturations of 88–91%. The recording montage consisted of central and occipital EEG, left and right EOG, chin EMG, EKG, oral and nasal airflow integrated into one channel, chest and abdominal respiratory effort, oximetry and leg EMG. Audiovisual monitoring was also performed.

Sleep architecture was scored according to standardized criteria (14). Results included: sleep latency, 6 minutes; total sleep time, 217 minutes; time in bed, 301 minutes; sleep efficiency (total sleep time/time in bed), 72%; stage 1, 25%; stage 2, 65%; stage 3/4, 0.0%; REM sleep, 10%; REM latency, 174 minutes; transient arousals, 164 over the entire night, 27 of which lasted more than 1 minute.

Severe sleep-disordered breathing was noted. Obstructive hypopneas and apneas throughout the night totaled 448 events, yielding a respiratory disturbance index (RDI) of 124 obstructive apneas and hypopneas per hour of sleep. Oximetry revealed oxyhemoglobin saturations in the low 80% range for the majority of the night (minimums were 71% in NREM sleep and 63% in REM sleep). Periodic limb movements totaled 26 events per hour of sleep, although most limb movements were associated with arousals related to apneic events.

A page-by-page review of the sleep recording and videotape did not reveal any evidence of confusional arousals, REM sleep behavior disorder, sleepwalking episodes, unusual behaviors or arousals from sleep.

The interpretation of the sleep studies included: i) severe obstructive sleep apnea syndrome, ii) hypoventilation, iii) resting tachycardia and iv) periodic limb movements largely associated with respiratory events.

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This interpretation was agreed upon by the expert witnesses for both the defense and the prosecution.

**THE TRIAL**

The case for the defense largely rested on medical testimony that the defendant was suffering from a severe sleep disorder, sleep apnea syndrome, which led to his fatally shooting his wife accidentally during his sleep. In expert testimony for the defense, a pulmonologist who consulted on the management of the patient during his inpatient admission in February 1994 testified as to the decreased vigilance and level of arousal he observed, which, in his opinion, could be associated with confusion and memory loss. Another pulmonologist, with additional certification in sleep disorders medicine, stated that he thought it was likely that the combination of repetitive sleep deprivation, the resulting extreme levels of sleepiness and the severe levels of hypoxemia that may occur in patients with sleep apnea may have produced a state of sleep drunkenness during an arousal from sleep in which the defendant may have accidentally shot his wife. Another scenario cited by this witness was the possibility that the patient had a hypnagogic hallucination related to extreme fragmentation of sleep secondary to the sleep apnea, in which he dreamed that he was hunting, picked up a gun and shot his wife, perhaps mistaking her for an animal.

Additional evidence in support of the defense was presented by the county coroner who examined the victim and the murder scene. He testified that the close range and angle of the shooting was suggestive of an accident rather than a deliberate act.

The case for the prosecution largely rested on the evidence that the defendant had sufficient motive for killing his wife, as reviewed above, and on the improbability that such an incident may have occurred during his sleep, based on several lines of evidence: i) the defendant was suffering from sleep apnea syndrome at the time of the shooting; ii) the condition of sleep apnea or arousals associated with sleep apnea were not sufficient evidence to establish that the behavior occurred during sleep; iii) despite the wide prevalence of sleep apnea syndrome, there have been no cases reported in the medical literature in which a patient with sleep apnea has killed someone related to a confusional arousal directly associated with an arousal from sleep apnea; iv) while cases of sleep-related injuries are not uncommon, homicides by firearms during sleep are rare; v) research studies exploring the neuropsychological effects of repeated partial arousals during sleep, of hypoxemia related to sleep apnea and of the relations between daytime hypoxemia in patients with chronic obstructive pulmonary disease and neuropsychological performance suggest that the most likely mental status of someone arousing from a sleep-related apneic event was one of impaired performance and decreased arousal, as opposed to an acute confusional arousal; vi) clinical experience with a patient population at high risk for sleep-related violence (i.e. veterans with combat-related post-traumatic stress disorder) does not indicate that repetitive states of sleep dissociation in which patients reenact killing someone result in homicide, even though sleep-related injuries are not uncommon; vii) based on the sleep studies and a review of the audiovisual recording, there was no objective evidence to suggest that the defendant was suffering from REM sleep behavior disorder or sleepwalking, or that he would be prone to having acute confusional arousals, all of which have previously been shown to be associated with sleep-related injuries.

At the trial, the jury found the defendant guilty of first-degree murder with a mandatory sentence of life imprisonment without parole. Newspaper interviews with anonymous jury members after the trial suggested that, from the outset of the case, they did not seriously consider the defense that the defendant may have shot his wife accidentally during his sleep, but gave considerable weight to the evidence substantiating a strong motive for the shooting, his failure to attempt to stop her bleeding after the shooting and the difficulty of removing a firearm from underneath a water bed mattress while asleep.

The events of the trial captured considerable interest in the local as well as national media. The media interest appeared to revolve around the notion that the defense was "weird" or bizarre, with considerable public speculation as to whether or not such a thing could really happen.

**DISCUSSION**

This case report documents the first case, to our knowledge, in which a confusional state related to arousals associated solely with sleep apnea in a non-intoxicated person was used as a defense of criminal homicide. This case is important to the field of sleep medicine for several reasons. In one community sample (15), the occurrence of sleep-disordered breathing (RDI ≥ 15) in men between the ages of 40 and 49 years was estimated to be 6.7–16% of the community. In another community-based adult sample (16), 26% of males were reported to have RDIs of ≥ 15. Given this high prevalence, the question of whether or not this type of behavior can occur, irrespective of whether or not it may have occurred in this current case report, has significant implications for the field.

Sleep disorders that have more commonly been associated with sleep-related injuries should be consid-
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ered in the differential diagnosis in this case. Consideration of each of the following presupposes that the defendant was asleep at some point and that he became fully alert only in response to the sound of the gunshot. It is possible that the defendant did not sleep prior to the homicide and that his behavior was simply a continuation of his waking pattern of domestic violence. Several reviews have focused on isolated case reports of violent behavior in which another person was harmed or killed (6,7,12), and on more common forms of sleep-related injury, in which the injury is typically incurred by the sleeper as opposed to someone else (1–3). Overlap in diagnostic categories is found in these reviews, including: i) classical repetitive NREM parasomnias such as sleepwalking, ii) arousals and behaviors associated with dream imagery (these may include REM sleep behavior disorder as well as NREM parasomnias associated with more vivid sleep-related cognitive activity) and iii) acute confusional arousals commonly resulting from forced arousals from “deep” sleep or in association with a toxic-metabolic state such as acute alcohol intoxication. In the current case there was no evidence to suggest that either sleepwalking or REM sleep behavior disorder was present at the time of the homicide. No adult history of sleepwalking episodes was noted, and on sleep studies there was either no delta sleep or continuous delta sleep without spontaneous arousals. During REM sleep, muscle atonia and an absence of unusual periodic limb movement activity were noted. No history of repetitive dream-enacting behaviors was reported to suggest an REM sleep behavior disorder (17,18).

If the homicide did occur in relation to a sleep disorder, the most likely condition would have been an isolated, acute confusional arousal. Situations which may have increased the likelihood of such an arousal (7,19) include: i) acute sleep deprivation in excess of that associated with chronic sleep apnea, ii) acute intoxication or withdrawal from alcohol or other recreational substance use, iii) the addition of an acute stressor such as knowledge of an impending marital separation and 4) a forced or startled awakening. The timing of the episode early in the night, the defendant’s admission that he must have shot his wife, and his reported amnesia for the event support a confusional arousal. Several details, however, make this scenario less tenable. Most notably, in contrast to the case reports in the literature in which an acute confusional arousal has been implicated, there was considerable evidence in this case that the behavior was not senseless, but rather was consistent with a pattern of violent behavior during waking. Evidence against a confusional arousal includes the apparent lack of remorse over the incident when the police arrived, which stands in contrast to the horror, guilt and remorse more traditionally described in relation to these acts. Considering such a diagnosis, it would seem that conditions over and above the defendant’s chronic sleep apnea syndrome would have needed to be present to precipitate such an arousal. We can only speculate, without any objective evidence, that any of these complicating factors were present on the night of the shooting.

There is little information in the literature to either support or refute the notion that arousals related to sleep apnea can be associated with sleep-related violence of the type seen in this case. A review of the literature using a Medline search (English language only, humans only, 1966–1994) did not reveal any similar incidents of homicidal behavior that were related to arousals associated with sleep apnea. In a review of 100 cases of sleep-related injuries (1) (none of which were explicitly cited to have resulted in a bed partner being killed), only one case occurred in a patient with sleep apnea. Guilleminault and Ssilvestri (20) report two examples of children whose sleepwalking episodes appeared to be triggered by snoring episodes. One case report, in which a drunken man became violent with police on forced arousal (8), suggested that “a combination of sleep apnea with alcohol consumption and respiratory pathology [was] the cause of this patient’s episode of disturbed behavior”. In a similar case, an intoxicated man with mild sleep apnea was forcibly aroused from sleep, then injured two family members with knives before they could flee (M. Mitler, personal communication) (21). In these cases, however, it is far from clear whether the confusional arousals were associated directly with sleep apnea. A more likely scenario was that the forced awakening itself, perhaps influenced by alcohol intoxication or withdrawal from the effects of alcohol earlier in the night, independent of sleep apnea, may have led to the acute confusional state. This view is consistent with a review of impulsive acts and confusional states by Bonkalo (6), who noted that these behaviors commonly occur on forced arousal, not on spontaneous awakening. Guilleminault (22) reported that the more typical movements associated with sleep apnea include a sense of restlessness, with increased tossing and turning in the night. Occasionally patients may stand up and then abruptly collapse on the floor, or they may report sleepwalking episodes with typical features of confusion and disorientation. Guilleminault reported sleepwalking in 10% of his population. It is not clear whether this differs from the normal population or from patients with other types of sleep disorders.

Several questions still remain regarding the pathophysiological relationships between sleep apnea and more complex behavioral parasomnias. Controlled studies of the epidemiology and pathophysiology of motor activity as well as of neuropsychological func-
Neuropsychological deficits are well recognized in patients with obstructive sleep apnea syndrome (23,24). Impaired daytime vigilance, predicted best by measures of hypoxemia and in part by nocturnal sleep disruption, may lead to attentional and memory deficits. More general dampening of the intellectual function necessary for planning, shifting and constructive abilities, i.e. related to performance in executive and psychomotor tasks, may be directly related to the degree of nocturnal hypoxemia. The effects of chronic hypoxemia in patients with chronic obstructive pulmonary disease on neuropsychological testing (25) reveals that the degree of hypoxemia is directly related to impairments in perceptual learning, problem-solving abilities, alertness, psychomotor speed and simple motor performance, whereas measures of verbal and general intelligence appear relatively unaffected by the degree of hypoxemia. Studies do not show a clear relationship between psychopathology and sleep apnea syndrome (26,27). The effects in normal subjects of repetitive arousals during sleep on performance during the night include impaired psychomotor performance, decreased vigilance and a higher arousal threshold (28). In the current case, in which chronic hypoxemia, repetitive nocturnal arousals and nocturnal hypoxemia were present, the most probable mental status on arousal from an apneic event would have been impaired vigilance, impaired neuropsychological performance on simple and complex motor acts, impaired planning and execution of motor acts and a high arousal threshold. This complex of neuropsychological deficits would seem to reduce the probability of a complex motor act occurring on arousal from a sleep apneic episode.

Based on their review of injurious behavior associated with sleep, Mahowald et al. (3) offered seven guidelines to assist the clinician in evaluating the putative role of an underlying sleep disorder in a violent act. In applying these guidelines, we believe that the defense claim that the defendant was in a confusional state when the homicide falls short in several respects. i) While the defendant did have a sleep disorder, clear associations between this disorder and sleep-related violence have not been established. In this case there was no prior history of unusual behavior related to arousals associated with sleep apnea. ii) Consistent with other reports of sleep-related violence, the duration of the current behavior as reported was brief. iii) In this case, it was not established that the act was senseless, or without apparent motivation. Rather, the timing of the act and a prior history of injurious behavior toward his bed partner as well as women in prior relationships had been established. iv) In the current case, the victim was merely present, but motivation for injuring the victim had previously been established. v) While the defendant did not flee or attempt to cover up the act, there was a relative lack of remorse on his part at the time police officers arrived on the scene. vi) Amnesia for the event was present as reported by the defendant. vi) Incomplete information in this case prevents drawing conclusions regarding the timing of events to establish whether the event occurred on awakening or in response to a forced arousal.

Medicolegal issues and guidelines for future cases

This case raises the medicolegal concept of automatism. The law requires that criminal liability attaches only when the person acts with some form of intent, or mens rea. In contrast, automatism is a legal defense for criminal behavior which occurs while the defendant is unconscious or semi-conscious. A person who acts in an automatic state does so without intent, exercise of free will, or knowledge of the act (29), and experiences a corresponding subsequent amnesia for events which occurred during that automatic state (30). In addition to sleep-related behavior, other medical forms of automatism include those related to epilepsy (31,32), head trauma, hypoglycemia (33), drug use (34), delirium and psychogenic causes. Statutory and case law varies in the United States as to whether automatism is considered a defense separate from legal insanity, with its attendant subsequent psychiatric hospitalization, and whether the burden of proof is placed on the prosecution or the defendant (35). Also, altered consciousness or volition associated with sleep apnea could potentially be used to support a finding of diminished capacity, especially as a mitigating circumstance in a death penalty sentencing proceeding that would reduce the severity of the penalty imposed from death to imprisonment.

In formulating guidelines for estimating the likelihood that sleep apnea may result in an automatism, several cautions should be mentioned. First, as in the cases of epilepsy and drug-induced automatisms, potentially violent behavior associated with sleep apnea is extremely rare. This makes systematic assessment of these phenomena nearly impossible, relying mainly on indirect evidence. Second, given the nature of homicidal behavior, witnesses to the act may not be available, necessitating reliance on physical evidence and the recollection of the perpetrator, which if an automatism did occur, will not result in an accurate description of the events. Finally, in jury trials, the public perception as to whether or not a defense of an automatism is believable will play a significant role in the
ultimate verdict. This is especially important in cases in which medical evidence supporting the existence of an automatism is unclear given the rarity of such incidents. For example, an increased frequency of defenses of ictal or interictal violence may relate to a public perception that violent epileptic automatisms are common, despite medical evidence which disputes this notion. In the current case, the public perception was clearly one of disbelief, perhaps mixed with a fear of the unknown, viewing the defense as odd or bizarre, somewhat in contrast to the view of sleep disorders specialists who may be more willing to entertain such notions based on clinical experience with patients who sleepwalk or who have had confusional arousals.

Given these cautions, we offer the following guidelines to aid sleep specialists in establishing the medical likelihood that violent behavior may result from sleep apnea with associated confusional arousal:

1) The diagnosis of sleep apnea syndrome should be established by a sleep specialist. This information should be obtained by a medical history, a sleep/wake history and a polysomnographic assessment. Audiovisual monitoring and apnea screening should be performed.

2) A history of prior automatic "unconscious" behaviors should be present or objectively demonstrated on polysomnographic recordings. If there is a question as to whether or not provocation of the arousal by the victim may have occurred, then imitation of this provocation should be considered in the sleep laboratory with appropriate security precautions.

3) The unconscious behaviors noted above should demonstrate the aggressive potential of the automatic behaviors to produce the behavior in question. Two caveats here are in order. First, the absence of polysomnographic documentation of violent behaviors cannot be taken as definitive proof that such a behavior did not occur given the rarity of capturing sleep-related behaviors in a sleep laboratory setting. Second, even the documentation of discrete sleep-related behaviors in the laboratory setting cannot be used as definitive proof that the behavior in question occurred, given the extreme rarity that sleep-related behaviors, when present, result in violent outcomes.

4) The diagnosis of sleep apnea is not in and of itself sufficient in a defense of criminal activity related to an automatic behavior. To date, there is no medical evidence to suggest that uncomplicated sleep apnea is associated with homicidal behavior. The sleep history and evaluation should focus on the concurrent presence of another sleep disorder, such as sleepwalking or acute confusional arousals that have previously been associated with violent behaviors. In addition, even in these instances, consideration should be given to establishing the presence of complicating factors, such as alcohol or drug use or intoxication, acute emotional stress, sleep deprivation or a forced arousal, at the time of the incident that may increase the likelihood of an automatic sleep-related behavior.

5) Currently, there is no evidence to suggest that sleep apnea syndrome is associated with a mental disorder of which violent daytime behavior is a manifestation. As reviewed above, studies do not clearly show an increased incidence of psychopathology in patients with sleep apnea. Rather, the characteristic neuropsychological changes seen in patients with sleep apnea include alterations in vigilance and in the planning and performance of motor acts. The presence of recurrent violent behavior in a sleep apnea patient should alert the clinician to the presence of an independent, comorbid, mental disorder. A psychiatric examination and psychological and neuropsychological testing may help clarify the differential diagnosis.

6) Finally, it is helpful in making the diagnosis of apnea associated with confusional violence if the behavior in question has no apparent motive and is consistent with the person's characteristic daytime behavior. Extensive interviews with family members and friends of both the victim and defendant, a usual procedure in forensic criminal responsibility evaluations (36), will help clarify their customary relations.

REFERENCES


