Sleep Breathing and Sleep Movement Disorders Masquerading as Insomnia in Sexual-Assault Survivors

Barry Krakow, Anne Germain, Dan Tandberg, Mary Koss, Ron Schrader, Michael Hollifield, Diana Cheng, and Tonya Edmond

A descriptive, hypothesis-generating study was performed with 156 female sexual-assault survivors who suffered from insomnia, nightmares, and posttraumatic stress disorder (PTSD). They completed 2 self-report sleep questionnaires to assess the potential presence of intrinsic sleep disorders. Seventy-seven percent of the sample (120 of 156) endorsed additional sleep complaints, besides their insomnia symptoms, that indicate the potential presence of sleep-disordered breathing ([SDB] 81 of 156, 52%) and sleep-related movement disorders ([SMD] 94 of 156, 60%). The potential for SDB was strongly correlated with the body mass index (BMI), an increase in arousal symptoms, and greater total PTSD severity. In some sexual-assault survivors, the relationship between sleeplessness and posttraumatic stress may be caused or exacerbated by intrinsic sleep disorders, and not be solely a function of psychophysiological insomnia—the traditional diagnostic term usually offered to explain the sleep problems associated with PTSD. Prevalence studies that use objective diagnostic evaluations such as polysomnography (PSG) are needed to test these hypotheses.

INSOMNIA is common following sexual assault. In rape survivors with chronic posttraumatic stress disorder (PTSD), insomnia is an integral part of the arousal response[1-5] to intrusive stress elements such as nightmares, traumatic memories, and other unpleasant imagery.[1,4-11] In some cases, insomnia may signal the onset of depression, a disorder with extensive comorbidity with PTSD.[12] However, the diagnosis and treatment of insomnia in sexual-assault survivors is not likely to be managed by sleep disorder specialists. The main sources of healthcare delivery for these individuals are primary care providers or a variety of mental health specialists, including rape crisis centers,[13-16] most of whom have little training or experience in the treatment of sleep disorders.[17] While this may be appropriate if PTSD is viewed as a primary psychiatric problem with secondary sleep disturbances,[4,8] it could be problematic if the insomnia is not caused exclusively by anxiety, depression, or PTSD, but rather by coexisting intrinsic sleep disorders. Anecdotally, snoring, sleep-disordered breathing ([SDB] e.g., sleep apnea), sleep-related movement disorders ([SMD] e.g., restless legs and periodic limb movements), and parasomnias (e.g., sleep terrors, sleepwalking, and rapid eye movement [REM] sleep behavior disorder) all have been reported in PTSD.[10,18-22] And, all of these sleep disorders can present as insomnia, in part because "insomnia" is the most common term in use by the general population to describe disturbed sleep[23,24] and the PTSD literature routinely uses this term.[8,25] In sleep apnea, the typical presentation includes both nocturnal and daytime hypersomnolence. Therefore, a complaint of insomnia is conceived as a paradoxical manifestation in sleep apnea. Patients who present with sufficient insomnia symptoms can cause confusion in establishing a diagnosis of SDB.[26] Speculatively, PTSD patients with comorbid sleep apnea may mask their sleepiness with hypervigilance and then unwittingly describe their problem as insomnia.

To explore the problem of insomnia in PTSD from a sleep medicine perspective, this descriptive, hypothesis-generating preliminary study was performed (1) to investigate the prevalence of insomnia in a sample of sexual-assault survivors with PTSD, (2) to estimate the prevalence of potential undiagnosed intrinsic sleep disorders such as SDB and SMD that may be masquerading as insomnia, (3) to determine if a correlation exists between obesity and the potential for SDB, and (4) to

From the Department of Emergency Medicine and the Department of Psychiatry, School of Medicine, University of New Mexico Health Sciences Center, Albuquerque, NM; Department of Psychology, University of Montreal, Montreal; Laboratoire des rêves et des cauchemars, Hôpital Sacré-Coeur, Montreal, Quebec, Canada; University of Arizona Health Sciences Center, Tucson, AZ; Department of Mathematics and Statistics, University of New Mexico, Albuquerque; Department of Family and Community Medicine, School of Medicine, University of New Mexico Health Sciences Center, Albuquerque; and George Warren Brown School of Social Work, Washington University, St Louis, MO.

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Address reprint requests to Barry Krakow, M.D., UNM Sleep Research, 4775 Indian School Rd NE, Suite 305, Albuquerque, NM 87110.

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determine if the potential presence of a sleep disorder correlates with an established measure of PTSD severity.

METHOD

Subjects

The Human Research and Review Committee of the University of New Mexico Health Sciences Center approved this study. One hundred fifty-six females participated (95% diagnosed as PTSD: 97% sexually assaulted, 51% raped and 49% with other forms of sexual and/or physical assault), with a mean age of 36.01 ± 10.85 years (mean ± SD; range, 18 to 74); their ethnicity was 67% Caucasian, 14% Hispanic, 2% Native-American, 2% African-American, and 15% Other/Mixed ethnicity. The mean educational level was some college or vocational/technical school, and most participants (64.7%) reported a household income between 0 and $20,000. They were recruited from Albuquerque to participate in a nightmare treatment program for which they were paid $15 to complete the intake interview. Enrollment commenced in 1994. The study involves a cognitive-behavioral treatment for chronic nightmares in female sexual-assault survivors with PTSD. Preliminary results are reported elsewhere.[27] Inclusion criteria were as follows: (1) adult female, (2) unwanted sexual experience(s), (3) weekly nightmares, (4) insomnia complaints, and (5) posttraumatic stress symptoms. Individuals were excluded if they were actively psychotic or intoxicated and if their nightmares were less than 3 months' duration. After a complete description of the study to the subjects, written and oral informed consent was obtained.

Instruments

Each subject completed a 4-hour intake process to assess nightmares, sleep disturbances, and PTSD. For this study, specific responses extracted from each subject's 2 sleep questionnaires (Pittsburgh Sleep Quality Index [PSQI][28] and the Sleep Survey from the University of Wisconsin, Wisconsin Sleep Cohort Study[29]) were used for the analyses along with a complete PTSD scale (Posttraumatic Stress Scale–Interview Version[30]).

The self-rated PSQI assesses sleep quality and disturbances during the past month. Nineteen individual items generate 7 component scores measuring various sleep parameters, which then yield a summed global score. Acceptable measures of internal homogeneity (Cronbach's $\alpha = .83$) and test-retest reliability (correlation coefficient = .85, $P < .001$) have been obtained.[28] Questions extracted from the PSQI (described later) were used in analysis 1 for the prevalence of insomnia based on stringent diagnostic criteria.[24]

The self-rated Sleep Survey has been used previously as a screening instrument in 1 of the largest epidemiological studies of sleep disorders.[29] Although the instrument has not yet been validated, it provides both quantitative and qualitative information that would be routinely elicited during the course of a 1-hour patient intake interview by a sleep disorders specialist, and thus provides the essential historical information used to determine the need for overnight sleep testing (polysomnography [PSG]) or for initial treatment plans directed at conditions that may not require polysomnography. Categorical, ordinal, or Likert scales are used for all questions.[29] To ensure the most conservative interpretations of these self-reported responses, answers to questions about symptom frequency on the Sleep Survey were considered positive only if patients reported occurrences more than weekly (often, 5 to 15 per month; almost always, 16 to 30 per month; range, 5 to 30 episodes per month). This provided the appropriate clinical material to establish a "potential diagnosis" based on the criteria and practice parameters of the American Sleep Disorders Association[31] and/or other experts[24] in the clinical field of sleep disorders medicine (described later). A few dichotomous questions were included and scored positive if answered affirmatively. Questions extracted from the Sleep Survey (Table 1) were used in analysis 1 to establish the prevalence of any type of insomnia complaints and in analyses 2 and 3 for the prevalence of potential SDB and SMD.

The PTSD Symptom Scale-Interview (PSS-I) measures PTSD symptoms according to DSM-III-R criteria. It is a 17-item semistructured interview to evaluate the severity of PTSD symptoms as experienced by the patient in the 2-week period preceding the interview. The PSS-I contains 3 symptom subscales: intrusion, avoidance, and arousal. The severity of each symptom is rated on a 4-point scale: 0, not at all; 1, a little bit; 2, somewhat; and 3, very much. The sum of all ratings gives a total score. Subscale scores are obtained by adding the ratings for each specific cluster only. Reliability has been determined by a Cronbach α value of .85 for the overall scale. The α coefficients for the symptom cluster subscales were as follows: reexperiencing, .69; avoidance, .65; and arousal, .71. The total severity score correlated significantly with other measures of psychological distress.[30] The PSS-I scores were used in analysis 4 to examine the relationship between PTSD and SDB and SMD.

Potential Diagnoses

Three diagnostic groupings are relevant to this exploration: insomnia (insomnia complaints *v* insomnia based on stringent diagnostic criteria), SDB, and SMD. Since this research was conducted in an exploratory framework, potential diagnoses were established solely on the basis of subjective information extracted from the questionnaires. No actual diagnoses were established with PSG or other objective measures for testing sleep disorders. This is a hypothesis-generating study, and the attempt was to discern if subjective complaints raise the suspicion for intrinsic sleep disorders. The study is not designed to establish whether such potential diagnoses are valid. Furthermore, because no diagnoses were formally established, it was deemed more conservative not to use the standard nosology of sleep medicine, but rather to use a more general nosology encompassing the various sleep disorder groupings. SDB represents the global concept of SDB and does not denote the specific disorders obstructive sleep apnea or upper-airway resistance syndrome; SMD represents the global concept of SMD and does not denote the specific disorders restless legs syndrome, periodic limb movement disorder, sleep terrors, REM behavior disorder, or other parasomnias, or even the distinct possibility that chronic nightmare sufferers move a lot during sleep secondary to anxiety dreams.

Criteria for Potential Diagnoses

Insomnia. The 3 most common descriptors of an insomnia condition were assessed on the Sleep Survey: difficulty initiating

Table 1. Sleep Survey Questions to Assess the Prevalence of Insomnia Complaints, SDB, and SMD

Parameter	%
Assessment of insomnia complaints	
Difficulty getting to sleep	71
Wake up during the night and have a hard time getting back to sleep	63
Wake up too early in the morning and can't get back to sleep	46
Assessment of SDB	%
Have you ever been told that you snore?*	61
According to others, how often do you gasp, choke, or make snorting sounds during sleep?	21
How often have you awakened with the feeling of gasping or choking?	21
According to others, how often do you seem to have momentary periods during sleep when you stop breathing or you breath abnormally?	11
How often do you have feelings of excessive daytime sleepiness?	51
How often do you fall asleep or doze momentarily—watching TV, reading, etc.?	35
How often do you fall asleep or doze momentarily—at meetings, in church, etc.?	20
How often do you feel the need for caffeine or other stimulants to stay awake during the day?	36
Assessment of SMD	%
According to what others have told you, how often do you kick or make disruptive movements during sleep?	52
Has anyone who shared your bedroom ever moved to another bedroom because of your kicking or disruptive movements?*	27
How frequently do you have restless legs, or bothersome twitches?	46

NOTE. Percentages reflect endorsement of an affirmative response to a categorical question* or, in the case of all additional questions, endorsement of a frequency range equivalent to 5-30 episodes per month.

sleep, difficulty maintaining sleep, and early-morning awakenings. More stringent criteria were applied to establish insomnia based on Morin's[24] work, which attempts to provide clinicians with accurate diagnostic criteria for the disorder commonly termed insomnia. In this instance, the objective was to distinguish those with clinically apparent insomnia complaints from those who met more stringent diagnostic criteria. Speculatively, this approach might serve to distinguish patients who suffer solely from insomnia versus those who may actually have additional sleep disorders that exacerbate or cause the insomnia. Stringent criteria extracted from the PSQI include all of the following: (1) subjective poor sleep quality, (2) sleep onset latency longer than 30 minutes, total wake time after sleep onset longer than 30 minutes, or sleep efficiency (total sleep time/total time in bed) lower than 85%, (3) symptom frequency at least 3 times per week, (4) symptom chronicity more than 6 months, (5) subjective reports of daytime impairments attributed to sleep difficulties, and (6) associated with significant distress or social and occupational impairments.

SDB. SDB, e.g., obstructive sleep apnea, is characterized by upper-airway collapse during sleep, which reduces or stops airflow. Oxygen desaturation may follow, but electroencephalogram (EEG) microarousals invariably occur to reinitiate normal breathing or as a response to the increased work of respiration. This cycle repeats hundreds of times, leading to severe sleep fragmentation. Thus, the sufferer complains of unrefreshing or nonrestorative sleep and usually daytime sleepiness. Upper-airway resistance syndrome, a variant of apnea,[32] produces a similar clinical picture by increasing the "work of breathing." EEG microarousals occur, followed by daytime fatigue and sleepiness. The clinical suspicion for SDB focuses on snoring and related breathing difficulties,[29,33] and the presence of excessive daytime sleepiness, although many patients present with the complaint of insomnia, notably sleep maintenance insomnia. The standard of care for the diagnosis of SDB is PSG[33]—the all-night sleep study that monitors breathing, the brain (EEG), the heart (ECG), eye movements (electrooculogram), oxygenation, chest and abdominal excursion, and limb movements. Likely indications for PSG in this sample were assessed with an algorithm[31] condensed for the specific diagnosis of SDB (Fig 1). The algorithm is based on the premise that the combination of excessive daytime sleepiness and snoring is highly suspicious for SDB and warrants PSG unless it is otherwise explainable. Strong relationships have been shown between sleep apnea and both snoring and excessive daytime sleepiness.[34] However, this algorithm represents the latest policy statement on practice parameters from the American Sleep Disorders Association (1997) and has not been tested for validity; rather, it is offered as a clinical tool for the practicing sleep disorders specialist. Prior efforts in the field of sleep medicine research to establish more refined algorithms (e.g., using equations) have met with some success,[35] but none have specifically worked with female populations or included the newer diagnostic category of upper-airway resistance syndrome.

SMD. The most common SMDs are restless legs occurring prior to sleep and periodic limb movements (leg jerks) occurring with sleep. With restless legs, the individual suffers unpleasant sensations in the legs, which can only be eliminated by moving them. Most patients with restless legs also have leg jerks.[36,37] Classic leg jerks involve periodic movements during sleep with an extension of the big toe in combination with partial flexion of the ankle, the knee, and sometimes the hip and upper limbs. Patients with restless legs and leg jerks complain mostly of daytime fatigue, but many present to a sleep disorders clinic with a chief complaint of insomnia, either sleep-onset or sleep-maintenance. In some cases, leg jerks represent arousal activity linked to SDB.[36,37] PSG is also used to diagnose leg jerks.[38]

Research Questions and Statistical Analyses

The study was designed to answer 4 questions of clinical interest, which are listed in the Results. Descriptive statistics were used in analyses 1 to 3. In analysis 2, a logistic regression was conducted to uncover any association between the body mass index (BMI), age, and recommendation for PSG.[39] In analysis 3, a 2-tailed Fisher's exact test was used to compare the proportion of SMDs in the 2 groups defined by the presence or absence of SDB. In analysis 4, a multivariate analysis of covariance with the covariates BMI and age was performed to adjust for differences in definable sleep groupings.[39]

RESULTS

Analysis 1: Using Stringent Diagnostic Criteria, What Is the Prevalence of Insomnia in a Sample of Sexual-Assault Survivors With Nightmares and PTSD?

Clinically apparent complaints of sleep-onset or sleep-maintenance insomnia or early-morning awakenings (or in combination) were present in 132 participants (Table 1). The remaining 24 endorsed insomnia complaints, but at a subclinical level.[38] However, only 12 patients (7.7% of the total sample) met all stringent diagnostic criteria for insomnia.[24]

Analysis 2: Using an Algorithm From Sleep Practice Parameters, What Percentage of the Sample Might Be Referred for PSG to Rule Out SDB?

Frequencies of specific symptoms relevant to SDB are listed in Table 1. Eighty-one participants, or 52% of the sample (61% of those with insomnia complaints), met criteria for referral for PSG to evaluate SDB (Fig 1).

The mean BMI was significantly higher in the group recommended for PSG (28.91 ± 7.07 kg/m^2) compared with those who would not be referred (24.64 ± 6.67 kg/m^2), even after adjusting for age characteristics using analysis of covariance ($F(1, 143) = 14.1$, $P = .0003$). Unsurprisingly, age was significantly associated with the BMI ($F(1, 143) = 12.31$, $P = .0006$); however, a logistic regression relating a referral for PSG (the response variable) to the age and BMI (continuous explanatory variables)[39] showed the BMI to be a significant predictor of PSG (chi-square = 9.1203, $df = 1$, $P = .0025$, corrected for overdispersion, concordance = 72%), while age was not a significant predictor of PSG (chi-square = 1.3461, $df = 1$, $P = .246$).

Analysis 3: What Is the Prevalence of SMD in the Sample?

Frequencies of specific symptoms related to SMD are listed in Table 1. Ninety-four participants, or 60% of the sample (71% of those with insomnia complaints), endorsed complaints of SMD. Divid-

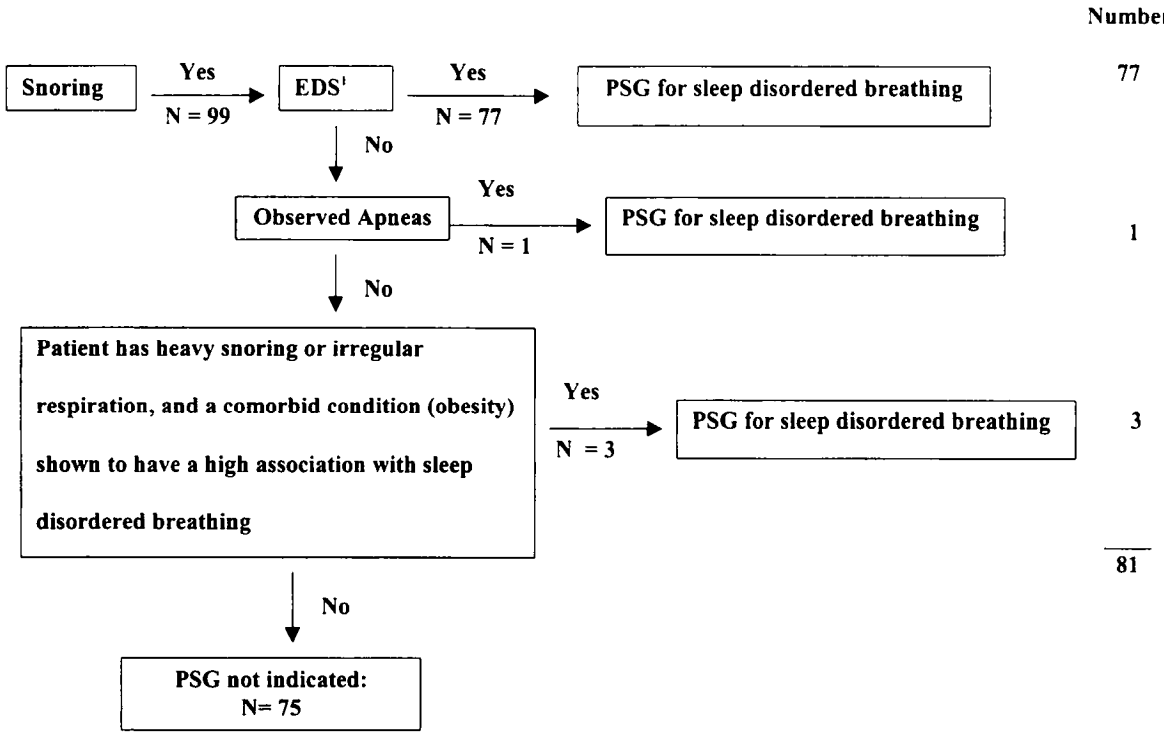

Fig 1. Modified algorithm from the American Sleep Disorders Association (1997) to assess the likelihood of needing PSG for SDB. 1. Excessive daytime sleepiness (EDS) was considered positive if the patient answered affirmatively to 1 or more of 4 questions and with a frequency of 5-30 times per month: (1) subjective evaluation of EDS, (2) falling asleep while watching television, reading, etc., (3) falling asleep in public places, and (4) need for coffee or stimulants to stay awake during day.

ing subjects with potential SMDs into 2 groups—those with potential SDB and those without SDB—showed that 68% of the SDB group exhibited symptoms for SMD, compared with 52% of the group without evidence for SDB ($P = .05$).

Analysis 4: Can the Four Definable Sleep Groupings (no SMD or SDB, SMD only, SDB only, and both SMD and SDB) Be Discriminated on a Validated Measure for PTSD (PSS-I)?

For all participants, the PSS-I score for PTSD severity (mean ± SD) was 29.15 ± 11.37, which is slightly less than the 1993 validation study by Foa et al.[30] (33.58 ± 9.94) on rape victims only. Values from the PSS-I were organized according to the 4 groups, which demonstrated an ascending pattern of PTSD severity (mean ± SD), starting with no SMD or SDB (24.75 ± 12.31), SMD only (25.98 ± 9.42), SDB only (26.76 ± 12.64), and SMD and SDB (34.55 ± 9.72). The individual subscales showed a similar ascending pattern. These groups and the PSS-I scores were then analyzed using multivariate analysis of covariance with the covariates age and BMI to adjust for differences. The multivariate tests screened for any differences in the groups on any of the 3 PSS-I component scores and total score. Analysis was made on a 2 × 2 layout[39] using SMD and SDB as factors (Table 2).

The multivariate test shows an interaction between SMD and SDB on PSS-I components, as well as main effects that are both significant. The univariate tests show the same conclusions for the total PSS-I and the intrusion and avoidance scales, but the arousal scale shows only SDB as significant. Examining the cell means and appropriate contrasts for the intrusion and avoidance scales shows that, on average, the presence of either SMD or SDB alone was not significantly associated with elevated intrusion or avoidance. However, the presence of both SMD and SDB was associated with substantially elevated intrusion and avoidance, and this is the nature of the interaction between SMD and SDB. The significance demonstrated for SDB with arousal is because SMD appeared unrelated to arousal, while the presence of SDB was associated with substantially elevated arousal. Age was not significantly associated with any of the PSS-I subscales or total PSS-I, but the BMI was positively associated with arousal ($F(1, 143) = 8.77$, $P = .0036$) and total PSS-I ($F(1, 143) = 5.10$, $P = .0255$).

Table 2. Multivariate and Univariate Analyses of Covariance for PSS-I

Parameter	SMD	SDB	SMD × SDB Interaction
Multivariate analysis of covariance (covariates are age and BMI; tests of Wilks, Pillai, Hotelling-Lawley, and Roy are identical)			
PSS—all components (all *df* = (3,136))	F = 3.04*	F = 3.75*	F = 4.59†
Univariate analysis of covariance (covariates are age and BMI)			
Individual PSS components (all *df* = (1,138))			
1. Intrusion	F = 7.53†	F = 6.23*	F = 10.29†
2. Avoidance	F = 6.25*	F = 6.61*	F = 5.39*
3. Arousal	F = 2.35	F = 10.31†	F = 0.39
Total severity	F = 6.90†	F = 10.61†	F = 5.34*

*$P < .05$.
†$P < .01$.

DISCUSSION

Insomnia complaints were invariably reported by a group of sexual-assault survivors with nightmares and PTSD, yet only 12 of 156 met the stringent criteria established by Morin[24] for the diagnosis of insomnia. This finding suggests that "insomnia" is a difficult term to use in scientific investigations, and it may function more as a clinical term whose meaning is mostly relevant as it is described and discussed between doctor and patient. Nonetheless, insomnia is a major factor in the arousal process of PTSD, and established treatments for insomnia, for example, cognitive-behavioral therapies such as sleep hygiene education, stimulus control, and sleep restriction therapy, may provide considerable benefit for appropriate patients.[23,24,40]

The main hypothesis-generating result from the study is the finding that 3 of every 4 women in the sample (90% with clinically apparent insomnia complaints) endorsed specific sleep symptoms at a

frequency highly indicative of potential intrinsic sleep disorders, notably SDB (52% of the sample) and SMD (60% of the sample). Although these percentages represent potential values, it is thought-provoking to compare them with prevalence estimates in the general population, e.g., 1% to 5% for SDB and 5% to 34% for SMD.[41] To gain further perspective on the potential clinical relevance of these findings, Young provided this comment about our sample: "Using over 500 women [in her sample from the general population] ages 30 to 60 [based on the same questions we used to solicit symptom occurrence and frequency], the prevalences of [potential] intrinsic sleep disorders in your study are 5- to 10-fold greater than would be expected" (T. Young, personal communication, January 1998).

The findings also indicate that this potential for SDB and SMD has an association with more severe PTSD, but the degree is not precisely measurable from this study. Simple speculation offers the parsimonious view that if sleep quality is more severely compromised and fragmented (the core pathophysiology of SDB and SMD), then daytime energy and coping skills may suffer as well, potentially leading to greater anxiety and other forms of distress. Conversely, successful treatment of sleep apnea and/or leg jerks might lead to improvement in daytime energy and coping and subsequent reductions in PTSD severity. This would imply the need to screen for the presence of intrinsic sleep disorders in sexual-assault survivors who complain of insomnia, nightmares, and PTSD. The BMI, a well-established marker for SDB, could be a particularly useful parameter. Programs that treat sexual-assault survivors (e.g., rape crisis centers) could add a sleep disorders screening protocol to their evaluations, including measurements of height and weight.

At present, however, no well-documented prevalence or substantial clinical treatment data exist to support the use of such a screening protocol. Epidemiological evaluations of specific populations, such as women who present to a rape crisis center or victims of other traumatic events, will be necessary to determine whether the prevalence of intrinsic sleep disorders is higher than previously perceived and, if so, is this clinically relevant? Such a prevalence study must include objective measures for testing (e.g., PSG). In a related field of psychiatry, the only previous research found no significant differences in the prevalence of sleep apnea and nocturnal myoclonus in patients with major affective disorders (primarily depressive disorders).[42] However, it should be noted that this research was conducted 10 years before the discovery of upper-airway resistance syndrome, and therefore, it may need to be repeated given the very high rates of comorbid depression observed in sleep apnea patients.[42] Additionally, treatment studies of PTSD patients that investigate therapies for SDB with continuous positive airway pressure (CPAP) breathing masks, oral appliances, and possible surgery,[33,42,43-46] or therapies for SMD with pharmacotherapy such as low-dose carbidopa/levodopa, oxycodone, and/or clonazepam,[36,37] would shed more light on the impact that disturbed sleep may have on the PTSD process. A recent case report suggests that improvement in sleep and PTSD is not inconsequential[47] following CPAP therapy for comorbid sleep apnea. In clinical experience with patients who present with sleep disorders and PTSD, we have also observed reductions in nightmares and posttraumatic stress following successful treatment of SDB.[48]

Finally, previous research has categorized a number of factors that modify a victim's response to sexual abuse, for example, characteristics of the crime, locus of control, coping ability, life stress, personality variables, and social network.[49-52] Our present findings suggest that the BMI and the potential for intrinsic sleep disorders may prove to be important modifying factors as well. For example, SMD and/or SDB may more readily explain the "sleep problems" of PTSD in some of our participants. Moreover, research is needed to determine if intrinsic sleep disorders are present prior to an assault and, if so, whether they pose a risk for the development or exacerbation of PTSD. Or from a different perspective, is PTSD a catalyst that can unmask a preexisting subclinical sleep disorder? Such speculations integrate with and expand the construct of "sleep disturbance as the hallmark of posttraumatic stress disorder."[11] Prospective, longitudinal, diagnostic, and treatment studies in which weight, sleep, and posttraumatic stress are monitored following acute sexual assault or other types of acute trauma will help to further define the sleep disorders–PTSD relationship.

Without a random sample, a major limitation of this study is selection bias. The recruitment strategy enrolled adult female sexual-assault survivors with

PTSD who complained of chronic nightmares and insomnia. Treatment was offered to reduce or eliminate disturbing dreams, which has been shown to improve subjective sleep quality.[53] Patients participated not only to treat their nightmares but also to possibly improve their disturbed sleep; and therefore, people with more sleep problems (and therefore, potentially more underlying sleep disturbances) may be overrepresented in our sample. Nearly all of our patients have PTSD, all have nightmares, and 85% have clinically apparent insomnia; as such, for this hypothesis-generating study, they constitute a select group of sexual-assault survivors that may not represent this specific population. The more important limitation is that no objective testing confirmed these potential sleep disorder diagnoses. Moreover, the algorithms to determine the potential presence of sleep disorders are based on clinical practice parameters, not validated formulas, and thus despite our attempts at ensuring conservative estimates, the estimates may in fact be overinclusive. Also, this study did not address comorbid psychiatric disorders, health status, or medication usage, all of which can complicate a patient's sleep profile. Last, insomnia in any type of patient, with or without psychiatric comorbidity, may be comorbid with other sleep disorders. As such, the findings of this study may be more relevant to insomnia patients in general and less so to specific subpopulations such as PTSD patients.

Despite the surprising and provocative results of this descriptive research, the study design and bias do not provide definitive answers to the questions raised, and more importantly, they add little to our understanding about the extent and direction of the relationship between sleep and PTSD. However, the hypotheses generated do provide clinical and research constructs that could guide future investigations in determining whether intrinsic sleep disorders are a previously unrecognized component of PTSD in sexual-assault survivors, or possibly other types of trauma survivors. In the interim, because insomnia is such a prevalent and important aspect of the arousal process in PTSD, it seems reasonable to inquire about symptoms of underlying sleep disorders (e.g., snoring, sleepiness, restless legs, and leg jerks) in select PTSD patients, particularly those with comorbid obesity.

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