Workup and indications for polysomnography in patients with sleep-related complaints

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A significant proportion of the population has chronic sleep problems necessitating an increasing involvement by the primary care physician. Also, the general patient population is becoming more familiar with these disorders and is seeking assistance. Because sleep studies are expensive and time consuming, adhering to the recognized indications for testing reduces the number of inappropriate studies. Under most circumstances, individuals with excessive daytime sleepiness and symptoms suggestive of obstructive sleep apnea are candidates for polysomnography. Other individuals with parasomnias or difficult-to-treat insomnia are also candidates for testing. In some circumstances, procedures designed to assess sleepiness may also need to be used to ascertain the impact of the disorder on daytime functioning and may be part of evaluations involving the transportation industry. Only after taking a thorough history and doing a physical examination can the physician make an accurate determination of the appropriate study type.

(Key words: polysomnography, sleep disorders, daytime fatigue, sleepiness, insomnia)

It seems there are never enough hours in the day—or is it night? Today’s pace has individuals spending less time sleeping and more time working and playing. This translates into a common chief complaint in the outpatient setting of daytime fatigue, tiredness, or sleepiness. With the growing number of people using the Internet to locate disease-specific information, it is common that the chief complaint is replaced by a request for testing or empiric therapy. It is easy for physicians in general to sidestep the complaint of fatigue or sleepiness by ordering routine blood tests, prescribing a short course of a sleeping pill, or by blaming the work schedule. After all, isn’t everyone tired these days?

Distinguishing “normal sleepiness,” that due to inadequate sleep from sleepiness due to medical disease or underlying sleep disorder can be difficult because sleepiness is the common final symptom that results from disrupted sleep, regardless of cause. The problem arises because treatment modalities may be significantly different, depending on the etiology. The differentiation lies in recognizing dysfunctional patterns of behavior as opposed to symptoms suggestive of underlying disease. In so doing, we must first recognize that sleepiness and poor sleep are symptoms and not diseases. Although not a disease, sleepiness can have serious ramifications.

Excessive sleepiness and the disorders of sleep result in poor performance, impaired functioning, and a subsequent increase in accidents. The seriousness of this problem is best described in recent studies depicting the hazard of driving sleepy to both society and individual health. Moreover, sleep-disordered breathing directly affects cardiovascular health and likely is an independent risk factor for mortality. Therefore, by questioning patients about sleepiness and identifying the problem, an appropriate evaluation and treatment regimen can be implemented that has an impact on patient health. How can we as physicians identify the pathologically sleepy patient? This article will focus on how to recognize these patients and when polysomnography is indicated.

The problem...the history

The prevalence of excessive daytime sleepiness is often quoted as less than 5%, but a more recent study in a population of drivers and other data suggest that it may be much higher. One problem with measuring the prevalence is that defining and quantifying sleepiness are difficult. Differentiating sleepiness, fatigue, weakness, and depression is somewhat difficult but may be accomplished using the history and physical examination findings coupled with some selected testing.

Several assessments of sleepiness have been developed to address different aspects of the symptom and to help with our understanding of the physiology behind the symptom. The most widely used test is the Multiple Sleep Latency Test (MSLT), which is the current “gold standard” for determining the physiologic level of sleepiness. The MSLT is a time-consuming study that is performed across the course of a day and should not be used as a screening tool. As such, a good sleep history is essential and is aimed at uncovering common sleep disorders.

To objectively measure daytime sleepiness as part of the history and physical...
The Epworth Sleepiness Scale (ESS) is a simple, eight-question survey that has been shown to correlate roughly with sleep and the sleep pattern. The ESS is a tool to provide a semi-quantitative tool for the clinician to identify patients who are pathologically sleepy. Pathologic sleepiness is defined as an inability to control sleep onset or falling asleep at inappropriate times such as while driving a car, during meetings, or while having a conversation. Typically, this level of sleepiness interferes with the daily activities of the patient. Although it has not been fully validated, an ESS score of 8 to 12 is believed by many to be abnormal and deserves further investigation. We define a score of 8 as mild sleepiness, and a score of greater than 12 as moderate-severe sleepiness. A score of 12 correlates with a pathologically short sleep latency (<5 min) on the MSLT.

Beyond the ESS, important information includes details regarding sleep hygiene, sleep-wake schedules, alcohol or medication use, and the propensity for sleep. These aspects of the sleep history help to develop an assessment of factors that may be affecting circadian rhythms, altering sleep architecture, and address complaints related to sleep but not specifically covered by excessive sleepiness (Figure 2). Another helpful tool is to question spouses or roommates about snoring or acting out during sleep. An example of an effective strategy for determining the cause of sleepiness is to ask specific questions regarding a typical night of sleep. An average person requires approximately 6 to 9 hours of sleep a night but can compensate effectively in the short term if sleep time is limited. The less the limitation, the longer the person can maintain daytime performance without significant decrements. If an individual is keeping an intern-type schedule, surfing the Internet until 2 AM, or working several jobs, it will be an expected consequence to have daytime sleepiness. This source of sleepiness would be considered insufficient sleep syndrome or inadequate sleep hygiene and requires behavioral modification.

Other situations may arise that require behavioral therapy before initiating a referral for sleep study. If a patient complains of insomnia, yet is eating in bed, habitually watching the clock at night, or taking naps during the day, this individual has poor sleep hygiene and needs to be educated regarding an appropriate schedule and habits surrounding bedtime. Often, sleep logs are required to determine the amount of sleep, the sleep pattern, and actual activities ongoing during the night. In some instances, the alteration of the patient’s schedule may only occur under specific circumstance or at certain times of the month. One example is the individual who has excessive sleepiness or insomnia in the perimenstrual period. Such problems have both hormonal and behavioral components that need to be addressed.

Disturbances of normal circadian rhythm also can cause sleepiness. Typically, people who travel frequently or those who work different shifts as part of their employment complain of sleepiness and need education in addition to behavior modification. Occasionally, the employers of these patients need to be part of the solution.

Fatigue, sleep disorders, and psychiatric illness are at times difficult to differentiate and may coexist. Thus, it is important to tailor questions to the individual patient by doing a mini-mental status examination or a screening psychosocial history to rule out underlying anxiety, depression, or other psychiatric disease. A thorough review of symptoms may reveal difficulty concentrating, nocturia, morning headaches, or sexual dysfunction. These symptoms are frequently related to sleep disorders.

Physical examination and laboratory testing

Physical examination, focusing on the oropharynx, nasopharynx, and related structures, provides useful information that may guide the astute clinician in recognizing coexistent disease that may contribute to the patient’s symptoms. An erythematous posterior aspect of the oropharynx and swollen turbinates may be signs of rhinitis, sinus disease, or postnasal drip that can interfere with sleep or

![Activity Table]

<table>
<thead>
<tr>
<th>Activity</th>
<th>Scale</th>
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<tbody>
<tr>
<td>Sitting and reading</td>
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<tr>
<td>Watching television</td>
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<tr>
<td>Sitting inactive in a public place (such as a theater or a meeting)</td>
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<tr>
<td>As a passenger in a car for an hour without a break</td>
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<tr>
<td>Lying down to rest in the afternoon when circumstances permit</td>
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<tr>
<td>Sitting and talking to someone</td>
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<tr>
<td>Sitting quietly after a lunch without alcohol</td>
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<td>In a car, while stopped for a few minutes in the traffic</td>
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Figure 1. Adaptation of the Epworth Sleepiness Scale.6
breathing. In this case, a trial of nasal steroids or antihistamines may be indicated before polysomnography. Micrognathia, increased neck circumference, and other cephalometric abnormalities have been associated with obstructive sleep apnea9 and may help guide the choice of therapeutic interventions. (See article on obstructive sleep apnea [OSA], beginning on page S1.10)

In some instances, the evaluation may help to identify other medical disorders or complicating issues such as obesity. Despite the difficulties associated with treating obesity, a multidisciplinary approach to weight loss with formal dietary consultation and exercise routine is likely to benefit this population. Routine blood tests including a complete blood cell count, liver panel, electrolytes, and renal function are warranted in the sleepy patient. It is our practice, despite controversy,11,12 to obtain thyroid function studies early in the evaluation of sleepiness as hypothyroidism is easily treatable. This evaluation may need to be expanded on an individual basis to include a urinalysis, electrocardiography, chest radiography, erythrocyte sedimentation rate, or HIV testing, especially when considering chronic fatigue in the differential diagnosis.8

Polysomnography

In 1997, the American Sleep Disorder Association published a comprehensive article detailing the indications for polysomnography and related testing. These guidelines emphasize the importance of accurately diagnosing sleep disorders to the patient and society. They also caution against indiscriminate use of sleep testing procedures from an economic standpoint.

In general, polysomnography is most appropriately and commonly used to assess the abnormally sleepy patient. The most common disorder associated with pathologic sleepiness (Figures 3 and 4) is OSA. In OSA, the upper airway collapses and obstructs airflow, resulting in a recurrent pattern of arousal from sleep often associated with oxygen desaturations. This pattern leaves individuals unrefreshed even after prolonged periods of sleep and results in the typical complaint of daytime sleepiness. As such, screening appropriate individuals for this disorder is paramount. A history of excessive daytime sleepiness, habitual snoring, a body mass index greater than 35, and witnessed apneas is a clear indication for formal overnight polysomnography as patients with such a history have a greater than 70% probability of having sleep apnea.13

Narcolepsy is a fairly common genetic disorder with the following features: excessive daytime sleepiness (beginning at a young age); cataplexy (sudden loss of muscle tone, but not consciousness); hypnagogic hallucinations (during sleep), and sleep paralysis.14 In contrast to OSA, an MSLT is routinely performed the day after nocturnal polysomnography when attempting to diagnose this disorder.15 Observing sleep-onset rapid-eye-movement (REM) periods during polysomnography or MSLT is highly suggestive of narcolepsy.

Polysomnography is also indicated for the diagnosis of periodic limb movement disorder (PLMD). Periodic limb

**Checklist**

- **Sleepiness or fatigue complaints**
  - Does excessive sleepiness interfere with daily activities?
  - Do you experience drowsiness while driving?
  - Do you take naps or fall asleep during the day?
  - Do you snore? If so, how frequently?

- **Difficulty going to sleep**
  - Do you have difficulty getting to sleep, staying asleep, or returning to sleep after awakening?
  - Do you use over-the-counter or prescription medication to help you sleep?
  - Do you frequently wake up during the night?
  - Do you sleep better on weekends, days off, or when away from home?
  - Do you have difficulty sleeping because of anxiety or worrying?

- **Habits affecting sleep**
  - Do you smoke or drink alcohol or caffeinated beverages at night?
  - Do you read, eat, or watch TV in bed?
  - When you awaken at night, what do you do to get back to sleep?
  - Do you watch the clock if you are unable to sleep?
  - Do you sleep in on weekends or regularly take naps?

- **Miscellaneous**
  - Do you work at night or on a variable shift?
  - Does pain keep you awake at night?
  - Do you ever awaken with chest pain?
  - Do you have difficult-to-control high blood pressure or heart disease?
  - Do you act out dreams, kick, strike out, or have leg jerks at night?
  - Do you lose control of your muscles when you laugh, startle, or get angry?
  - Do you talk or walk in your sleep, or have you injured anyone during sleep?

**Figure 2. Questions routinely used while taking a sleep history.**
movements are involuntary, repetitive limb movements that cause arousals and fragmented sleep. Often, an association with restless legs syndrome exists. Restless legs syndrome (RLS) is a neurologic disorder characterized by unpleasant sensations in the legs that occur at rest and are relieved by movement. Polysomnography is not indicated in the diagnosis or treatment of RLS.

Parasomnias are phenomena that occur during sleep stages or arise out of transitions from one stage to another. Some of the more common parasomnias include sleep walking and sleep talking; however, some of these disorders can result in injury to the patient or the bed partner (or both). Therefore, they cannot be ignored. Simple parasomnias do not require polysomnography; they include bruxism, enuresis, night terrors, and nightmares.

Complicated or violent behaviors need to be investigated with polysomnography and possibly with 24-hour electroencephalographic monitoring. These disorders include seizures, REM-sleep behavior disorder, confusional arousals, and other movement disorders; they often have different etiologies and different modes of therapy. The therapeutic indications for polysomnography, as opposed to the diagnostic ones, include continuous positive airway pressure (CPAP) titration and evaluation of treatment interventions. Patients with neuromuscular disorders and respiratory insufficiency are a special population that should be studied. In addition, sleepiness in truckers or airline pilots warrants testing and follow-up to verify efficacy of treatment.

Another common sleep problem is insomnia. Insomnia is defined as difficulty initiating or maintaining sleep. Polysomnography has a limited role in this diagnosis unless sleep-disordered breathing is thought to be the cause of insomnia. Many other disorders, however, can present symptomatically as primary insomnia. If other characteristics that warrant polysomnography (PLMD, precipitous arousals, violent behavior, sleep-disordered breathing) coexist with insomnia, then polysomnography may be warranted, especially if symptoms persist despite several attempts at improving sleep hygiene, pharmacotherapy, or behavior modification.

Alternate testing methods
Because of the economic burden associated with standard overnight polysomnography, many have suggested alternative strategies specifically aimed at diagnosing sleep-disordered breathing. Limited diagnostic strategies and portable monitoring are discouraged because of a lack of standardization and the potential for missed diagnosis or improper therapy. Currently, only those patients with severe disease that is clinically attributable to OSA, who are unable to be studied expeditiously in a sleep laboratory, should forego standard polysomnography. Alternatively, those patients with known OSA may be able to undergo unattended portable recording for the sole purpose of evaluating response to therapy.

Comment
When evaluating the complaint of excessive daytime sleepiness, it is important to determine if the patient is merely tired or falls asleep at inappropriate times. The key element is a detailed sleep history that includes an objective measurement of sleepiness (that is the ESS). We have an algorithm at the Indiana University Center for Sleep Disorders (Figure 5) that is helpful in determining those patients who should undergo polysomnography. If the clinical history is highly suggestive of OSA (excessive daytime sleepiness, snoring, witnessed apneas, obesity), or periodic limb movements (leg jerks

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**Checklist**

- Obstructive sleep apnea
- Narcolepsy
- Insufficient sleep syndrome
- Periodic limb movement disorder
- Restless legs syndrome
- Shift work sleep disorder
- Irregular sleep-wake pattern
- Time zone change syndrome (jet lag)
- Central sleep apnea syndrome
- Hypnotic-dependent sleep disorder

**Checklist**

- Sleep-related breathing disorders
  - Obstructive sleep apnea
  - Central sleep apnea syndrome
  - Obesity-hyperventilation syndrome
  - Upper airway resistance syndrome

- Neurologic and movement disorders
  - Periodic limb movement disorder
  - Seizure disorders
  - Parasomnias such as sleepwalking
  - nocturnal movements
  - Narcolepsy or hypersonolence
  - REM-behavior disorder

- Therapeutic indications
  - Continuous positive airway pressure titration
  - Assessment of adequacy of sleep-related interventions
  - Respiratory insufficiency (that is, amyotrophic lateral sclerosis) and the titration of noninvasive ventilatory support
Patient complains of excessive daytime sleepiness (EDS)

History suggests behavioral or untreated medical illness as etiology of EDS

Correct behavior and/or Treat medical disorder

Symptoms resolve

Done

History includes:
- Snoring
- EDS
- Witnessed apneas
- Cardiovascular disease

History suggests:
- Active or violent behaviors during sleep
- OR
- Other parasomnias

History suggests:
- Active or violent behaviors during sleep OR
- Other parasomnias

Symptoms persist

Have patient undergo polysomnography

Hypersomnia without obstructive sleep apnea (OSA), professional transportation worker, or suspected narcolepsy

Diagnosis of OSA or other disorder confirmed by testing

Multiple Sleep Latency Test (MSLT)

Hypersomnia with no apparent cause or persisting after adequate therapy

Institute treatment and reevaluate

Pathologic sleepiness without sleep-onset rapid-eye-movement periods (SOREMPs)

Assess sleep-wake and circadian patterns
- Address any medical illness
- Reevaluate in 6 months

Identify and treat any medical or psychiatric disorders
- Reevaluate in 1 to 6 months

No abnormality

Identify and treat any medical or psychiatric disorders
- Reevaluate in 1 to 6 months

Sleepiness and SOREMPs noted

Evaluate causes and institute therapy
- Reevaluate in 1 to 6 months

Drug therapy
during sleep) are suspected, a standard polysomnographic recording is likely indicated. After the diagnosis, we use polysomnography to monitor adequacy of surgical interventions for OSA or to determine optimal CPAPs. Moreover, if violent behavior suggests complicated parasomnias, seizures, or REM behavior disorders, a sleep study is indicated. If, however, patients have hallmark features of narcolepsy or objective evidence is needed to determine true excessive daytime sleepiness (especially in occupations such as airline pilots, truck or bus drivers, and air traffic controllers) an MSLT may be needed, as well.

References

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