REVIEW

CME CREDIT

SELIM R. BENBADIS, MD
Sleep Disorders Center, Department of Neurology,
Cleveland Clinic Florida

Daytime sleepiness: When is it normal? When to refer?

ABSTRACT

Most disorders that cause daytime sleepiness can and should be identified and treated. Physicians should recognize that excessive daytime sleepiness is a symptom with serious consequences, including higher risk of accidents and, in the case of obstructive sleep apnea, hypertension, stroke, myocardial infarction, and death. An algorithm for office-based evaluation, indications for further testing, and sleep lab testing methods are described.

KEY POINTS

Excessive daytime sleepiness combined with either obesity or snoring warrants further investigation with polysomnography.

A key question is whether a patient with excessive daytime sleepiness actually falls asleep in inappropriate situations, or merely feels tired.

The best office test is the eight-question Epworth Sleepiness Scale.

Any patient who scores higher than 10 on the Epworth Scale, and especially any patient with suspected obstructive sleep apnea, should have further testing.

ABNORMAL SLEEPINESS poses a major public health problem, with serious consequences for both the individual and society. It impairs the individual's functioning, sometimes to the point of incapacity. It also causes industrial and motor vehicle accidents[1–3]; indeed, 16% to 20% of motor vehicle accidents—approximately 200,000 per year—are due to dozing at the wheel. Obstructive sleep apnea, the most common cause of daytime sleepiness, is linked to serious cardiovascular problems.

Yet, the National Commission on Sleep Disorders[4] found that the public and health care professionals alike generally either do not know about sleep disorders or underestimate their impact. The National Institutes of Health created the National Center on Sleep Disorders Research in 1993, in an effort to correct this lack of awareness.

Primary care physicians should not dismiss a patient's complaints of sleepiness or reflexively write a prescription for a sleeping pill. Sophisticated testing and specific therapy are available, and daytime sleepiness should be evaluated and treated, like any other symptom.

SLEEPINESS IS COMMON

The prevalence of excessive daytime sleepiness is difficult to determine, but it is common. Estimates range from 1% to 5% of the population.[5–9] These figures, however, may be low. Using a subjective scale (**FIGURE 1**) of 0 (not sleepy) to 24 (maximum sleepiness), recent surveys found that 2.5% to 6% of the population scored 15 or higher, and 26% to 32% scored 10 or higher.[10,11] Approximately one third of the US population complains of inadequate sleep.[12]

Sleepiness questionnaire

How likely are you to doze off or fall asleep in the following situations, in contrast to just feeling tired?

These questions are about your usual way of life in recent times. Even if you have not done some of these things recently, try to work out how they would have affected you.

Use the following scale to choose the most appropriate number for each situation:

0 Would *never* doze
1 *Slight* chance of dozing
2 *Moderate* chance of dozing
3 *High* chance of dozing

ACTIVITY	CHANCE OF DOZING
Sitting and reading	
Watching TV	
Sitting inactive in a public place (meeting, theater, etc)	
As a passenger in a car for 1 hour without a break	
Lying down in the afternoon when circumstances permit	
Sitting and talking to someone	
Sitting quietly after lunch without alcohol	
In a car, while stopped for a few minutes in traffic	
Total	

FIGURE 1. Epworth sleepiness scale. Each question is answered with a number from 0 (not at all likely to fall asleep) to 3 (very likely to fall asleep). This yields a total of 0 (minimum) to 24 (maximum). Scores above 10 warrant investigation.

SOURCE: JOHNS MW. A NEW METHOD OF MEASURING SLEEPINESS: THE EPWORTH SLEEPINESS SCALE. SLEEP 1991; 14:540–545.

OFFICE EVALUATION

In taking the history, the physician should review in detail:

- The patient's sleep-wake schedule
- Any abnormal behavior during sleep (usually noticed by the bed partner)
- Medications the patient takes
- Whether the patient falls asleep in inappropriate settings.

Such information may uncover an obvious cause for excessive daytime sleepiness, such as a circadian rhythm disorder (eg, shift work, irregular sleep-wake disorder), insufficient sleep, or sedative medications.

When is sleepiness abnormal?

Sleepiness is normal, up to a point. Normally, we feel sleepy in cycles, invariably after prolonged wakefulness. Daytime sleepiness is considered mild if it is apparent only during boring situations. For example, many people fall asleep while watching TV.

Daytime sleepiness is severe and excessive if the person cannot help falling asleep during more active situations such as while eating, talking, driving, or having sex. Unlike normal sleepiness, abnormal sleepiness tends not to be relieved by increasing the amount of sleep. Patients with severe, chronic daytime sleepiness often have additional symptoms such as difficulty concentrating, depression, sexual dysfunction, and headaches. Occasionally these are the presenting symptoms.

A key question: Does the patient actually fall asleep in inappropriate settings? The answer to this question distinguishes excessive daytime sleepiness from less-specific fatigue or tiredness, but sometimes the distinction is difficult. Occasionally, severe sleepiness becomes obvious when the patient dozes off during the history-taking or the examination, or in the waiting room.

The Epworth Sleepiness Scale (FIGURE 1), first described in 1991, is the most commonly used of several questionnaires that assess daytime sleepiness.[13] The patient answers each of eight questions with a number from 0 (not at all likely to fall asleep) to 3 (very likely to fall asleep). The total score ranges from 0 to 24. Although controversy exists about the upper limit of normal on the Epworth scale, scores above 10 warrant investigation.

CAUSES

Once you establish that the patient suffers from excessive daytime sleepiness, look for clinical clues to the cause.

Excessive daytime sleepiness can result from any condition that disturbs sleep; the international classification of sleep disorders lists many.[14] Two conditions, however, account for most cases: sleep apnea (approximately 50%) and narcolepsy (approximately 20%). The remaining 30% of cases are due to various conditions such as periodic limb

movement disorder (nocturnal myoclonus), idiopathic hypersomnia, and others.

Obstructive sleep apnea

In obstructive sleep apnea, the upper airway repeatedly closes off during sleep. The resulting hypoxia or respiratory effort briefly arouses the person, but when he or she falls asleep again, the cycle repeats itself, sometimes up to hundreds of times per night, although the person may not be aware of it. Sleep is thus fragmented; ie, the person does not go through the normal cycles and stages of sleep, and wakes up still feeling tired and sleepy.

The major daytime symptom of obstructive sleep apnea is excessive daytime sleepiness. Other symptoms include morning headaches and less-specific symptoms such as depression and decreased libido. The major nighttime symptom is snoring; very often the bed partner notices that the patient stops breathing for a few seconds and then resumes with a loud snort. Examination of the upper airways may disclose redundant neck tissue, macroglossia, retrognathia or micrognathia, or other malformations.

Obstructive sleep apnea is serious, currently underdiagnosed, and associated with increased risk of hypertension, stroke, myocardial infarction, and death. Most persons with obstructive sleep apnea snore, and the condition is particularly common in overweight persons. Excessive daytime sleepiness combined with either obesity or snoring warrants further investigation with polysomnography.

Narcolepsy

Narcolepsy is a genetic condition that is more common than may be generally thought; its prevalence is comparable to that of multiple sclerosis, approximately 50 per 100,000. It has four classic symptoms:

- Severe daytime sleepiness (the primary symptom), beginning in the teens or 20s
- Cataplexy (the most important auxiliary symptom): sudden episodes of loss of muscle tone, often causing a fall, triggered by emotions or laughter
- Sleep paralysis
- Sleep-related hallucinations.

Less classic symptoms include episodes of automatic behavior and disturbed nocturnal sleep. In the sleep laboratory, the hallmarks of narcolepsy are rapid eye movement (REM) sleep occurring near the onset of sleep (see "Multiple sleep latency test" below), and an increased number of awakenings. However, the polysomnogram may be normal.

Less-common sleep disorders

Idiopathic hypersomnia, another disease of the central nervous system, is less well defined than narcolepsy. It is also characterized by lifelong severe daytime sleepiness, but there is no REM sleep abnormality. In fact, the polysomnogram is most often normal. This condition, also known as "non-REM narcolepsy," remains a diagnosis of exclusion that should be made only by a sleep specialist, because a large proportion of patients suspected of having idiopathic hypersomnia have been shown to have a compensated form of sleep-disordered breathing known as upper airway resistance syndrome.[15]

Patients with **upper airway resistance syndrome** have recurrent airway closure that is not complete enough to cause episodes of apnea or hypopnea. However, the increased respiratory effort needed to keep the airway open causes recurrent arousals and sleep fragmentation. The increased respiratory effort can be shown using esophageal recordings.

Periodic limb movement disorder (nocturnal myoclonus), like sleep apnea, can cause excessive daytime sleepiness because of repeated arousals and sleep fragmentation. In this condition, arousals are caused by leg jerks that occur at regular intervals.

Abnormal sleepiness is a symptom that should be evaluated, like any other symptom

SLEEP LABORATORY EVALUATION

Polysomnography

The polysomnogram is a comprehensive recording of an entire night's sleep, scored according to strict criteria.[16–18] As implied by its name, the polysomnogram records several functions:

Stage of sleep. The polysomnogram includes an electroencephalogram, an electro-oculogram to monitor eye movements, and an electromyogram, all of which indicate sleep stage.

A detailed description of each sleep stage is beyond the scope of this article. In brief,

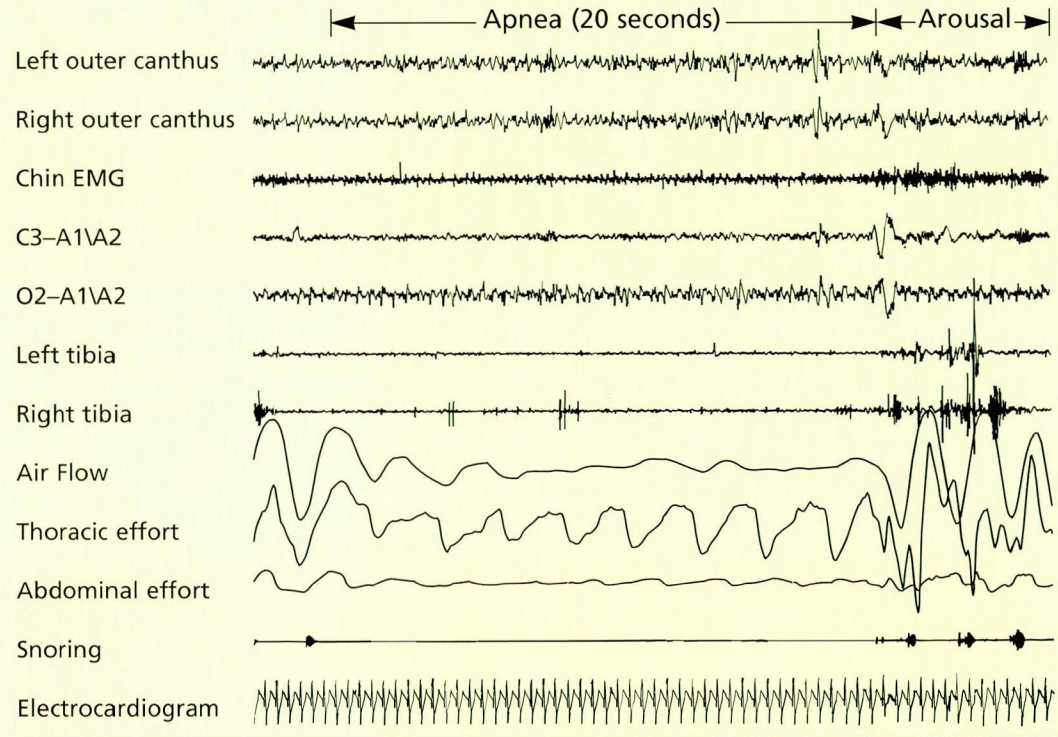

FIGURE 2. Obstructive sleep apnea, 30-second polysomnographic recording. Note that thoracic effort continued during the period of apnea.

50% of cases of excessive sleepiness are due to obstructive sleep apnea

sleep is divided into REM and non-REM sleep. Non-REM sleep is divided on the basis of the EEG into four stages, of which the last two are usually grouped under the term "slow-wave sleep." REM sleep is characterized by rapid eye movements (seen on the electrooculogram) and muscle atonia (seen on the electromyogram).

Respiratory variables include air flow, respiratory effort, oxygen saturation, and snoring.

Respiratory events are divided into episodes of apnea (cessation of air flow) and hypopnea (reduction of air flow). They can also be subdivided into the following:

- Obstructive events, during which the patient makes an effort to breathe (FIGURE 2).
- Central events, during which there is no respiratory effort.

The combined number of episodes of apnea and hypopnea per hour defines the *respiratory disturbance index*. Typically, respiratory events wake the patient (an arousal), and the polysomnogram allows us to document that the respiratory events cause sleep fragmentation.

Periodic leg movements cause repetitive bursts of electromyographic activity every 30 to 60 seconds and can also cause frequent arousals and sleep fragmentation.

"Sleep architecture" refers to total sleep time, sleep latency (ie, the time it takes to fall asleep), number of arousals, and distribution of various stages.

Heart activity is monitored by an electrocardiogram.

Other functions are occasionally monitored as well.

Multiple sleep latency test

The multiple sleep latency test (MSLT) is the objective method of choice to evaluate, document, and quantify excessive daytime sleepiness. The technique is relatively well standardized, according to detailed guidelines.[5,16,18] This test always includes four or five trials or naps, typically conducted at 10 AM, noon, 2 PM, 4 PM, and if necessary 6 PM, so that the test takes a whole day. At the specified time, the patient is placed in a quiet, dark, comfortable room and is asked to go to sleep (or not resist falling asleep). For each nap,

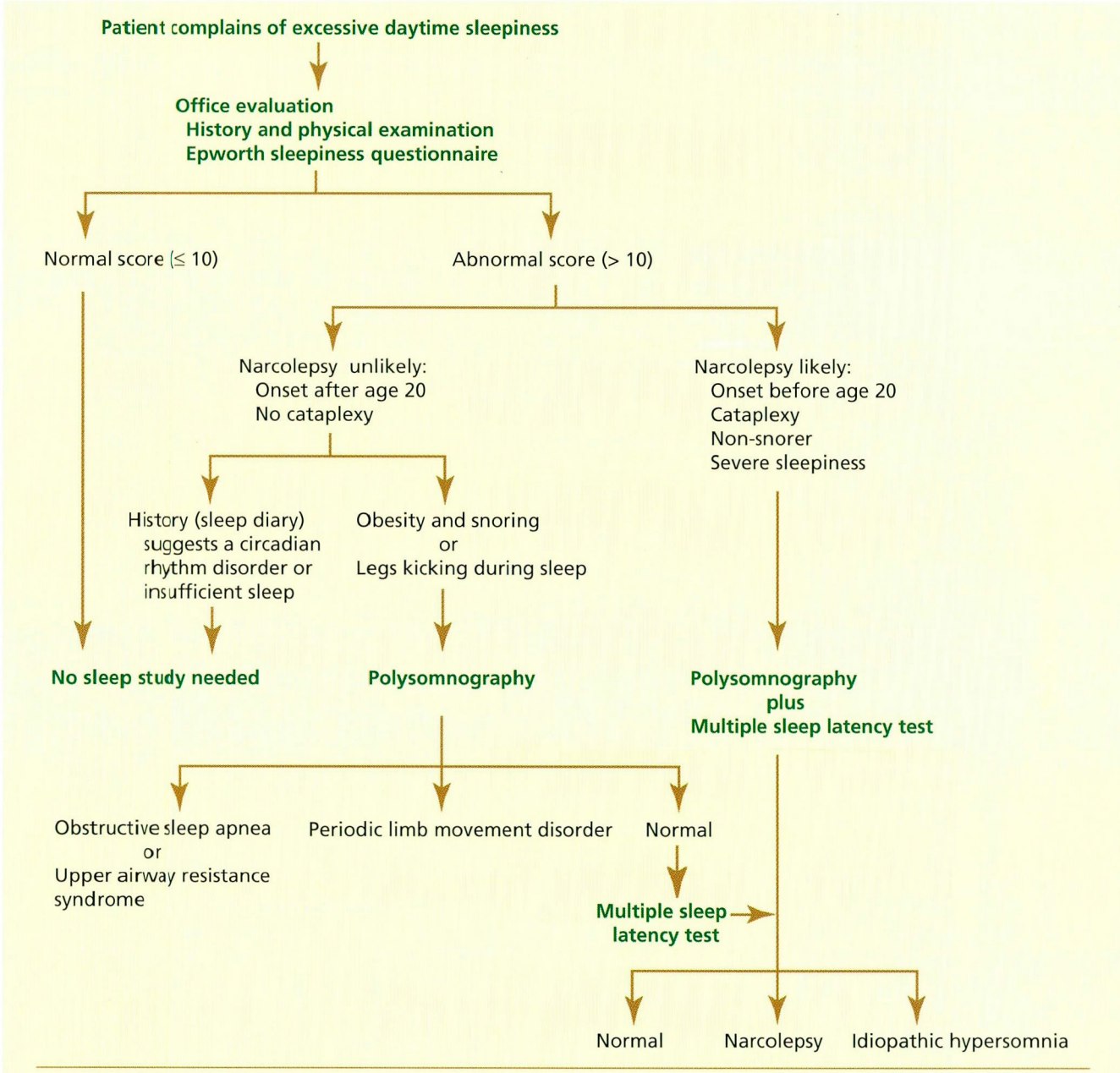

FIGURE 3. Office evaluation of excessive daytime sleepiness and indications for sleep studies.

sleep latency and stages of sleep reached are recorded according to standard criteria for sleep staging.[17]

Sleep latency. The sleepier the patient, the faster he or she falls asleep during each nap. Thus, the mean sleep latency is the overall measure of sleepiness: the sleepier the subject, the shorter the latency. A value longer than 10 minutes is usually considered normal; a value less than 5 minutes is considered indicative of pathologic and severe sleepiness.[19] Values between 5 and 10 minutes indicate moderate sleepiness, and may or may not be pathologic. Of note: the multiple sleep latency test measures sleepiness irrespective of its cause, which may be as simple as sleep deprivation.

Sleep-onset REM periods. The multiple sleep latency test also detects whether the

patient goes into REM sleep too soon after falling asleep. Going into REM sleep during a nap in the MSLT (ie, within 15 minutes of sleep onset) is called a *sleep-onset REM period* and is never normal, except in an infant.

People with narcolepsy classically have two or more sleep-onset REM periods on sleep testing,[20] but this finding is not specific. For example, sleep-onset REM periods can occur in severe cases of sleep deprivation and withdrawal from REM-suppressing medications such as tricyclic antidepressants. Furthermore, up to 25% of patients with severe obstructive sleep apnea have two sleep-onset REM periods on multiple sleep latency testing.[21] Therefore, sleep-onset REM periods should be interpreted with caution; narcolepsy remains essentially a clinical diagnosis.

Recent data suggest that a single sleep-onset REM period on the nocturnal polysomnogram may have a higher specificity for narcolepsy than two sleep-onset REM periods on the multiple sleep latency test.[22]

Methodologic questions. The instruction given to the patient during the multiple sleep latency test ("try to fall asleep; do not resist falling asleep") may seem inconsistent with trying to assess the patient's ability to stay awake. The wording of this instruction, however, seems to have only minor effects on sleep latency.[23,24] A more intuitive procedure is the maintenance-of-wakefulness test,[25] during which the subject is asked to *stay awake* while in a sleep-conducive environment (ie, a dark room). Although it is more similar to the "real-life" situation of trying to stay awake, this test is not as well standardized as the multiple sleep latency test. Only recently have normal values been published for the maintenance-of-wakefulness test, and its role in clinical sleep medicine may increase in the future.[25]

The multiple sleep latency test can sometimes be difficult to interpret, and different raters vary significantly in their findings for both sleep latency and whether a patient has sleep-onset REM periods.[26] Some controversy also exists about whether the median sleep latency should be used rather than the mean, but there seems to be little difference between the two measures.[27] The criteria used for sleep onset are also somewhat variable, but this also produces minor differences only.[28]

Morning headaches, decreased libido, and depression may signal sleep apnea

Because the test has some well-known limitations, several variations have been investigated. The standard test recognizes episodes of sleep only if they last at least 15 seconds (half of a 30-second "epoch," the standard unit of time during sleep testing). Yet episodes of sleep lasting 5 to 10 seconds, termed "microsleeps," have been associated with impaired performance.[29,30]

This limitation of the mean sleep latency test has prompted inquiry into alternative indices of sleepiness. Roth et al[31] proposed an index that would take into account the subsequent sleep stages; others studied whether sleep efficiency (*how much* the patient sleeps), rather than sleep latency (*how quickly* the patient falls asleep), might be a better measure of sleepiness.[32] Some investigators[33] reported that the sleep onset frequency (*how many times* the patient falls asleep) during the multiple sleep latency test was a better indicator of sleepiness than sleep latency.

WHO SHOULD BE REFERRED TO THE SLEEP LABORATORY?

FIGURE 3 is my algorithm for diagnosing the cause of excessive daytime sleepiness.

Excessive daytime sleepiness, as reflected by a score above 10 on the Epworth scale, warrants investigation. If the clinical presentation suggests sleep apnea (ie, obesity, snoring) or periodic leg movements (ie, report of legs kicking during sleep) then a simple polysomnogram is sufficient. If narcolepsy is suspected (onset before age 20, non-snorer, severe sleepiness), then both a polysomnogram and a multiple sleep latency test should be requested.

A multiple sleep latency test is needed if one needs objective evidence of sleepiness, eg, if the patient subjectively feels sleepy, but the polysomnogram fails to reveal its cause. Another use is in making decisions regarding the ability to drive or operate dangerous machinery.

In the current climate of cost-containment, the cumbersome nature of polysomnography and multiple sleep latency testing and their cost may be their most serious limitations. Portable polysomnographs, suitable for home use, are currently used in selected situations.[34] No home alternative exists for the

multiple sleep latency test.

Although clinicians may to a certain extent rely on subjective scales of sleepiness, the correlation of subjective methods with objective measures is far from perfect,[35,36] and in many instances the multiple sleep latency test will be necessary.

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ADDRESS: *Selim R. Benbadis, MD, Department of Neurology, Cleveland Clinic Florida, 3000 West Cypress Creek Road, Fort Lauderdale, FL 33309. E-mail: benbads@cesmtp.ccf.org.*