Maintenance of Wakefulness Test

by Cameron D. Harris, RPSGT

Hypersomnolence is a primary symptom of sleep disorders such as narcolepsy and obstructive sleep apnea. To provide objective measurement of hypersomnolence, laboratory tests such as the multiple sleep latency test (MSLT) and the maintenance of wakefulness test (MWT) have been developed. The MSLT was first described in 1978 by Richardson[1] and has well-documented normal values and standard procedures[2]. Mitler[3] introduced the MWT in 1982, but this test had not had well-defined normal values until Doghramji et al[4] published the results of a multi-center study in 1997.

The fundamental difference between the two tests is that the MSLT measures a patient's tendency to fall asleep whereas the MWT measures a patient's ability to stay awake. Both tests are able to discriminate between groups with different degrees of hypersomnolence; however, the specific clinical use of each test differs.

In clinical practice the MSLT is useful for documenting a patient's degree of sleepiness and has become a definitive test for diagnosing narcolepsy because of its ability to detect sleep-onset REM (rapid-eye movement) episodes. The MWT is used clinically to assess a patient's ability to maintain wakefulness under soporific conditions. Results from an MWT can be used to determine if the patient's ability to maintain wakefulness falls outside of the normal range. This is of particular value for determining efficacy of treatment. MWTs are often done for medico-legal reasons related to licensure issues for public transportation equipment operators such as pilots or truck drivers.

MWT protocol — a recommendation

There has not been procedural standardization for the MWT as there has been for the MSLT. Doghramji et al[4] provide a recommended protocol for the MWT based upon their experience with the study of normal subjects. It is advisable to adhere to these recommendations because this study provides the only currently published normative data for the MWT.

The protocol for the MWT is similar to the MSLT. The montage includes central and occipital electroencephalogram, chin muscle activity, and eye movements. There are somewhat more stringent requirements for

the physical facilities needed to perform an MWT. The room should be quiet, secure, and at a comfortable temperature. In contrast to the MSLT, for which the room should be as void of light as possible, the room used for an MWT should have a low constant level of light that allows the patient to see and focus on objects in the room; but it should not be overly stimulating. Doghramji et al[4] specify an illumination level of 0.10–0.13 lux, which is approximately equivalent to a night-light (7.5 watts) placed near floor level behind the patient.

Another important difference is that for an MWT the patient is to be in a sitting position. Doghramji et al[4] suggest that the patient be in bed with a back cushion that can support the head in a comfortable upright position. In many cases, it is more practical to seat the patient in a comfortable lounge chair that can elevate the legs.

The most important difference between an MSLT and an MWT is the instructions given to the patient just prior to each nap. During an MSLT, patients are instructed to try to go to sleep. For an MWT the patients should receive standard instructions such as, "Please sit still and remain awake for as long as you can." Patients should not be allowed to use extreme measures to stay awake such as slapping or pinching themselves or vocalizing.

A total of four naps should be attempted for an MWT at two-hour intervals beginning at 10:00 a.m. MWT trials are begun in a manner similar to an MSLT by performing an appropriate set of patient calibration maneuvers. There is some debate over the most effective definition of sleep onset. Doghramji et al[4] recommend that for routine clinical use, the definition for sleep latency in an MWT should be the same as that used for an MSLT. That is the time from the beginning of the nap trial to the first epoch scored as any stage of sleep. The nap is terminated as soon as the technologist recognizes sleep onset.

The MWT has not had **well-defined normal values** until publication of a recent study.

There are two options for terminating the nap trials if the patient does not fall asleep during a trial. Nap termination can be 20 minutes or 40 minutes after the trial start time. The mean sleep latencies differ for the two protocols because the maximum duration of 20 or 40 minutes is used in the calculation of the mean for trials when the patient does not fall asleep.

For the 20-minute protocol, the reported[4] mean for normals is 18.1 minutes plus or minus 3.6 minutes; and for the 40-minute

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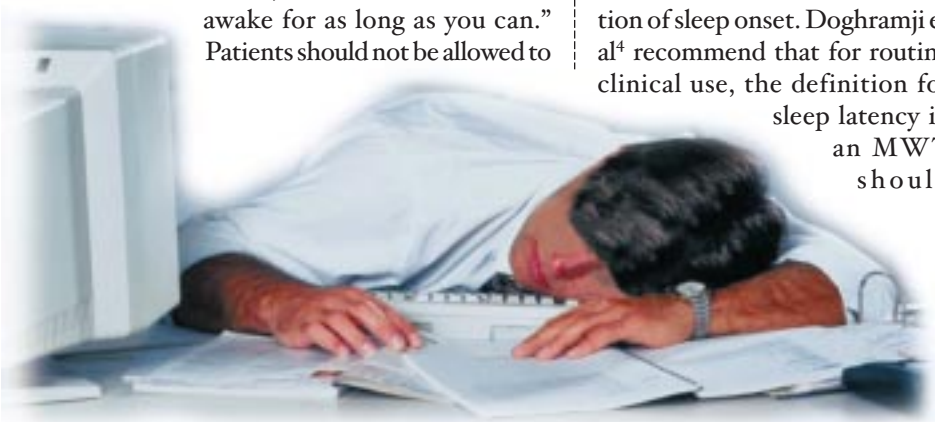

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protocol, it is 32.6 minutes plus or minus 9.9 minutes. Doghramji et al[4] recommend the shorter protocol for routine clinical use. The lower limit (mean minus two standard deviations) of normal mean sleep latency is 10.9 minutes for the 20-minute protocol. Latencies of this length or shorter mean that the patient cannot stay awake as long as 95 percent of the normal population.

A mean sleep latency of less than 11 minutes is clearly pathological; but from the perspective of determining the patient's ability to maintain wakefulness, this information is not useful. Many normal subjects remain awake for more than 20 minutes, so use of the 40-minute protocol is preferable for establishing ability to maintain wakefulness. A mean latency of 22.7 minutes is one standard deviation below the normal mean. For purposes of practical measurement of adequate alertness, a mean latency greater than 22 minutes will indicate that about 15 percent of normal subjects would have mean latencies less than this figure.

MWT reporting results

A report for an MWT should include a table that lists for each nap the start time, sleep onset latency, total sleep time, and sleep stages observed. The mean sleep latency across all naps should be calculated and comments about any significant occurrences before or during any nap should be recorded.

Reimbursement

One final factor that is important in the clinical setting is the proper procedure for billing. The procedural description for the MSLT CPT code, 95805, was modified in 1998 to include both the MSLT and the MWT. Using this code will ensure appropriate reimbursement.

Both the MSLT and MWT are important diagnostic procedures for the evaluation of sleep disorders. Both have similar protocols, but key differences in procedure allow the MSLT to measure the patient's tendency to fall asleep and the MWT to measure the patient's tendency to stay awake.

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