onstrate the sensitivity and specificity of topographic mapping of long-latency evoked potentials for diagnosis in individual patient care settings. When sensitive statistical tests (eg, z-scores) do detect changes in topographic maps of long-latency EP amplitudes, the reader is not able to differentiate between chance events, normal variants, and true pathology. Overall, long-latency evoked potential topographic brain mapping is still investigational.

Any clinical use of EEG brain mapping must be a direct extension of routine EEG testing. The actual EEG polygraph waveforms must be preserved on paper or on magnetic or optical storage medium. These EEG tracings must be interpreted thoroughly before interpretation of the computer-based analysis. The technical quality of these EEG readings must be satisfactory for purposes of clinical interpretation, according to accepted guidelines (for example, the American EEG Society "Guidelines in EEG and Evoked Potentials," and the International Foundation of Societies of Electroencephalography and Clinical Neurophysiology, "Recommendations for the Practice of Clinical Neurophysiology"). At present, there is no clinical application for computer-based clinical EEG analysis separate from analysis of the polygraph EEG. In order for these tests to be useful in clinical settings, they should be interpreted only by physicians with satisfactory skills, knowledge, and abilities in routine EEG as well as additional knowledge and experience with the relevant additional technical problems, artifacts, normal variants, and statistical issues encountered in EEG brain mapping.

Overall, these techniques have a very limited clinical usefulness. They are best used by physicians highly skilled in clinical EEG. The tests are only an adjunct to

and should be used in conjunction with traditional EEG testing. They are useful in only a small subset of patients who have been well selected on the basis of the clinical setting and results of more standard testing, such as MRI.

Executive summary. EEG brain mapping is of limited usefulness in clinical neurology. The tests are best used by physicians highly skilled in EEG, in conjunction with analysis of the concurrent polygraph EEG.

Therapeutics and Technology Assessment Subcommittee membership: Stanley van den Noort, MD (Chairman); John Conomy, MD; Edward Davis, MD; Peter Dyck, MD; Jack Greenberg, MD; Lawrence Jacobs, MD; Francis Kittredge, MD; Charles Markham, MD; Marc Nuwer, MD, PhD; and William Stuart, MD. Original draft prepared by Marc R. Nuwer, MD, PhD.

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Assessment: Intensive EEG/video monitoring for epilepsy

Report of the American Academy of Neurology, Therapeutics and Technology Assessment Subcommittee

Intensive EEG/video monitoring is widely accepted as a safe and clinically effective method for evaluating highly selected patients with seizure disorders. In this technique, 16 to 64 channels of EEG are recorded continuously onto a magnetic or optical storage medium while the patient remains in front of a closed-circuit television camera. There are several clinical indications for this: diagnosis, classification, localization, and other

reasons. For *diagnosis*, monitoring can help diagnose whether episodic spells are epileptic as opposed to non-epileptic. Disorders that may be confused with epilepsy include psychogenic seizures, syncope, cardiac arrhythmias, transient ischemic attacks, narcolepsy, other sleep disturbances, and other behavioral disorders. Although most of these disorders can usually be clearly distinguished from epilepsy on other clinical grounds, a

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small subset of these patients presents a clinical scenario in which epilepsy needs to be considered in the differential diagnosis. When initial standard evaluation techniques fail to resolve this latter issue and the spells are frequent enough to be caught, intensive EEG/video monitoring is a safe, effective, clinically valuable tool. For *classification* in patients suspected of having both epileptic and psychogenic seizures, intensive EEG video monitoring can be helpful for separating the two types of spells in documenting their coexistence. Monitoring can also occasionally provide the only source of information regarding which type of epileptic seizure occurs in an individual patient, which in turn can substantially influence choice of medications. *Localization* of the seizure focus is of paramount importance for patients being considered for surgical treatment of epilepsy. Intensive EEG/video monitoring is crucial to such localization issues. *Other indications* have also been proposed in a variety of clinical settings. For example, the factors precipitating individual seizures may be identified.

When properly used, this technology can have great benefit for patients and can be cost effective. For patients with a question of epileptic versus nonepileptic seizures, proper diagnosis is of paramount importance. It is unfortunate when patients are placed on long-term antiepileptic medication when they really do not have epilepsy. This mistake can be very costly in terms of dollars, drug side effects, and failure to correctly diagnose the original problem. For patients with a mixture of epileptic and psychogenic seizures, this technology can provide the crucial insights into which types of spells should be treated with antiepileptic medication and which should not. For patients with epilepsy of an unclear classification, this technology can indicate which category of medication is likely to be most successful in controlling the seizures. For patients with medically refractory partial complex seizures or certain other types of seizure disorders, surgical treatment of epilepsy can cure or very substantially improve many or most patients. This is especially true when the intensive EEG/video monitoring is carried out at a center with substantial experience in the surgical treatment of epilepsy, and the information gained is integrated with other types of clinical information. Surgical control of epilepsy can have an enormous impact on such a patient's future health, daily living activities, and ability to obtain employment. Without this technology, surgery for epilepsy could not be done safely.

In certain circumstances, intensive EEG/video monitoring can be accomplished in an outpatient setting. However, this requires that a technologist or other helper be available to keep the camera pointed to the patient, attend to the patient during epileptic seizures, correct technical problems as they occur, and observe the patient for occurrence of seizures that might go unreported by the patient. Especially with patients who have multiple complex partial seizures every day, intensive EEG/video monitoring could be done in an outpatient EEG laboratory or in a similar well-controlled outpatient environment. However, there are serious drawbacks to outpatient telemetry. Medications cannot in general be tapered off except in an inpatient setting, so the monitoring may take longer. No invasive procedures can be done in outpatients, such as recording from stereotactically implanted depth electrodes. Feasibility for outpatient testing may depend on the frequency of seizures, number of separate types of seizures in an individual, and the consistency of the behavioral and electrical seizure patterns.

There are no serious safety issues posed by this technology and its common clinical use.

Executive summary. Intensive EEG/video monitoring is safe and effective in several clinical settings. This is true especially when the technology is used in expert hands, in conjunction with other appropriate medical tests, for the purpose of diagnosis, classification, or evaluation for possible surgical treatment of epilepsy, especially when used in a center specializing in the comprehensive evaluation and treatment of patients with epilepsy.

Therapeutics and Technology Assessment Subcommittee membership: Stanley van den Noort, MD (Chairman); John Conomy, MD; Edward Davis, MD; Peter Dyck, MD; Jack Greenberg, MD; Lawrence Jacobs, MD; Francis Kittredge, MD; Charles Markham, MD; Marc Nuwer, MD, PhD; and William Stuart, MD. Original draft prepared by Marc R. Nuwer, MD, PhD.

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