A Guide to Neurodiagnostic Testing

Quality patient care through recording and study of the electrical activity of the brain and nervous system.

Neurodiagnostics is the allied health care profession that records, monitors, and analyzes nervous system function to promote effective treatment of pathologic conditions. Technologists record electrical activity arising from the brain, spinal cord, peripheral nerves, and somatosensory or motor nerve systems using a variety of techniques and instruments. Technologists prepare data and documentation for interpretation by a physician. Considerable individual initiative, reasoning skill, and sound judgement are all expected of the neurodiagnostic technologist.

Qualified neurodiagnostic technologists:

- are credentialed
- have met a minimum education level and related educational and performance standards
- meet continuing education requirements
- perform within a code of ethics and defined scope of practice
- are recognized by physicians, employers, the public, governmental agencies, and other health care professionals
- have a national society whose activities include lobbying for the profession
- contribute to the advancement of knowledge in neuroscience

Electroencephalogram [EEG] The Electroencephalogram [EEG] is a recording of the ongoing electrical activity of the brain. An EEG is used to assist in the diagnosis of epilepsy and a variety of neurological symptoms. These symptoms include common headaches, dizziness, seizure disorders, convulsions, changes in awareness, unexplained loss of consciousness, prolonged or unexplained coma, strokes, and degenerative brain disease. EEGs are also used to evaluate the effects of head trauma or the consequences of severe infectious disease. EEG information can help doctors determine medical and surgical treatment of epilepsy. Patients having surgery on arteries in the neck or around the heart often have EEG monitoring performed during the procedure, providing the surgeon with additional

Electroencephalogram [EEG] continued
information about brain function and assuring surgeons that the brain receives enough oxygen. EEGs also are used in determining causes for staring spells or inattentiveness in children.

In conducting an EEG, highly sensitive monitoring equipment records the activity through electrodes that are placed at measured intervals on a patient's scalp. The test is not painful and usually takes about 90 minutes. The principal role of the patient is simply to remain still, relaxed, and comfortable. During the test, the patient may be asked to take repeated deep breaths [hyperventilate] and/or be shown a strobe light that flashes at different speeds. It is very helpful to record sleep, so the patient may be asked to stay awake extra hours the night before the test. All these activities can help reveal different brain patterns that are useful for diagnosis.

Long-term Monitoring [LTM] refers to the simultaneous recording of brainwave activity (EEG) and clinical behavior (audio and video) over extended periods of time. LTM is used to evaluate patients with seizures and other disturbances of cerebral function and distinguish them from other physiological events. Recordings may take place in the hospital in fixed epilepsy monitoring or other patient rooms and in home settings (Ambulatory EEG -AEEG).

ICU/Continuous EEG Monitoring [cEEG] helps doctors monitor the brain activity of patients who are in a coma or deep unconsciousness in a specialized intensive care unit. It is particularly useful for patients who have experienced brain injuries or are at risk of bleeding or oxygen deprivation in the brain. The test helps doctors detect any abnormal changes in brain activity, such as seizures, which can be difficult to detect, as seizures can be very subtle in the critically ill. By monitoring brain activity over time, doctors can better understand the patient's condition and determine the most appropriate treatment to help the patient recover.

Intraoperative Neuromonitoring [IONM] is the use of neurophysiological monitoring techniques during surgery to provide information to the surgeon about nervous system integrity. The use of IONM guards against neurological complications during surgery and helps reduce the risk of negative surgical outcomes such as paralysis or stroke. IONM is used to monitor neurosurgical procedures and orthopedic procedures, including spinal surgery for scoliosis, tumors, and aneurysms; vascular surgeries; acoustic neuroma surgery; and carotid endarterectomy. Otolaryngologists use intraoperative neuromonitoring to monitor cranial nerve function during ear, nose, and throat (ENT) surgeries.

Polysomnogram [PSG] The Polysomnogram [PSG] is a recording during sleep that uses EEG and other physiologic monitors to evaluate sleep and sleep disorders, such as loud snoring, difficulty staying awake during the day, falling asleep at inappropriate times, insomnia, and uncontrollable urge to move

Polysomnogram [PSG] continued
one's legs. Physicians use polysomnograms to identify dysfunction in sleep/wake cycles, to diagnose breathing disorders during sleep, and to evaluate treatment of these disorders.

Evoked Potentials [EP] are recordings of electrical activity from the brain, spinal nerves, or sensory receptors in response to specific external stimulation. Evoked potentials are helpful in evaluating a number of different neurological problems, including spinal cord injuries, hearing loss, blurred vision and blind spots, acoustic neuroma, and optic neuritis. This test is commonly performed by the technologist during surgery on the spine to help the surgeon make sure nerves are not damaged during the operation. Evoked potentials also are performed in a clinical neurodiagnostic laboratory, using either earphones to stimulate the hearing pathway, a checkerboard pattern on a television screen to stimulate the visual pathway, or a small electrical current to stimulate a nerve in the arm or leg.

Nerve Conduction Studies [NCS] evaluate electrical potentials from peripheral nerves. Technologists stimulate the nerve with an electrical current and then record how long it takes the nerve impulse to reach the muscle. Patients referred for NCS tests suffer from nerve conditions which produce numbness, tingling, muscle pain, muscle weakness, muscle cramping, abnormal movements, pain or loss of sensation, or neurological diseases affecting primarily the feet, legs, hands, arms, back, and neck.

Magnetoencephalography [MEG] is a functional measurement of the magnetic fields naturally produced by electrical currents in the brain. This diagnostic test maps brain activity using sensitive magnetometers. Applications include localizing pathology, such as traumatic brain injury and focal epilepsy using source imaging and other methods of analysis.

Autonomics Autonomic testing is designed to measure how well the autonomic nervous system regulates internal organs and functions, such as blood pressure, body temperature, heart rate, digestion, and sweating. Tests include quantitative sudomotor axon reflex test (QSART), cardiovascular tilt-table test, deep breathing/Valsalva maneuver, thermoregulatory sweat test (TST), and bladder ultrasound. Autonomic dysfunction (also known as autonomic neuropathy) may be caused by autoimmune disease, diabetes, infections or even some types of medication.

A good resource for information about neurological disorders is available from the American Academy of Neurology [AAN]. They maintain a list of advocacy groups, as well as patient education literature.